PROJECT MANUAL FOR:

LOEB HALL – BUILDING DEMOLITION

PROJECT NO.: CP181011

AT:
UNIVERSITY OF MISSOURI - COLUMBIA
COLUMBIA, MISSOURI

FOR:
THE CURATORS OF THE UNIVERSITY OF MISSOURI

PREPARED BY:

PLANNING
DESIGN & CONSTRUCTION

CAMPUS FACILITIES
UNIVERSITY OF MISSOURI

January 14, 2020
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PROJECT NUMBER: CP181011

AT
UNIVERSITY OF MISSOURI - COLUMBIA
COLUMBIA, MISSOURI

FOR:

THE CURATORS OF THE UNIVERSITY OF MISSOURI

PREPARED BY:

PLANNING, DESIGN, AND CONSTRUCTION
CAMPUS FACILITIES
GENERAL SERVICES BUILDING
UNIVERSITY OF MISSOURI
(573) 882-6800

DATE: JANUARY 14, 2020
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MECHANICAL

The Engineers seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the engineer takes responsibility for the attached engineering specifications. The Engineer hereby disclaims any and all responsibility for project specifications other than these, included in these project documents, they being the responsibility of the other design professionals, whose seals and statements appear herein.

23 0900  Control Systems

1.13.2020

STATE OF MISSOURI
REGISTERED PROFESSIONAL ENGINEER
ANDREW J. REIN
NUMBER E-24151

(seal) Signature: Andrew J. Rein
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ELECTRICAL

The Engineers seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the engineer takes responsibility for the attached engineering specifications. The Engineer hereby disclaims any and all responsibility for project specifications other than these, included in these project documents, they being the responsibility of the other design professionals, whose seals and statements appear herein.

26 0519 Building Wire & Cable
26 0526 Grounding & Bonding
26 0529 Supporting Devices
26 0533 Conduit
26 0534 Boxes
26 0553 Electrical Identification
26 2726 Wiring Devices
26 2816 Enclosed Switches
26 6100 Testing
33 6113 Hydronic Energy Distribution
33 6311 Steam Energy Distribution General Requirements
33 6313 Steam Energy Distribution Piping
33 6315 Steam Energy Distribution Piping Specialties
33 6317 Steam Energy Distribution Manual Valves
33 6319 Pipe Supports for Piping
33 6321 Steam Energy Thermal Distribution Insulation
33 6333 Steam Energy Distribution Metering
33 6340 Steam Manholes and Structures
33 6341 Steam Manholes and Structure Accessories
33 6344 Steam and Condensate Chase
33 6345 Precast Concrete Utility Structures – Lids
33 6350 Cast-In-Place Concrete for Utilities
33 6351 Concrete Requirements – Concrete Formwork
33 6351 General Concrete Requirements - Concrete Reinforcement
33 6354 General Concrete Requirements – Waterproofing
33 3700 Concrete Repair

(seal) Signature: [Signature]

1.13.2020

Michael D. Mitchell

STATE OF MISSOURI
PROFESSIONAL ENGINEER

NUMBER
PE-2010019577

MU Project #CP181011
CIVIL ENGINEERING

The Engineer's seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the engineer takes responsibility for the attached engineering specifications. The Engineer hereby disclaims any and all responsibility for project specifications other than these, included in these project documents, they being the responsibility of the other design professionals, whose seals and statements appear herein.

31 2000 Earth Moving
33 1113 Water Distribution Piping
33 4100 Storm Utility Drainage Piping

(seal) Signature: 1/13/2020

MU Project #CP181011
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02 8233  Friable and Non-Friable Asbestos Removal
          Hazardous Building Materials Survey 07.26.19
          Hazardous Building Materials Survey 11.04.19

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DIVISION 4  MASONRY (NOT USED)
DIVISION 5  METALS (NOT USED)
DIVISION 6  WOOD AND PLASTICS, AND COMPOSITES (NOT USED)
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DIVISION 8  OPENINGS (NOT USED)
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ADVERTISEMENT FOR BIDS

Sealed bids for:

LOEB HALL –
BUILDING DEMOLITION
UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
PROJECT NUMBER: CP181011    CONSTRUCTION ESTIMATE $109,609 - $121,788

will be received by the Curators of the University of Missouri, Owner, at Campus Facilities, Planning, Design & Construction, Room L100 (Front Reception Desk), General Services Building, University of Missouri, Columbia, Missouri 65211, until 1:30 p.m., C.T., January 28, 2020 and then immediately opened and publicly read aloud.

Drawings, specifications, and other related contract information may be obtained at http://operations-webapps.missouri.edu/pdc/adsite/ad.html. Electronic bid sets are available at no cost and may be printed as desired by the plan holders. No paper copies will be issued. If paper copies are desired, it is the responsibility of the user to print the files or have them printed.

Questions regarding the scope of work and commercial conditions should be directed to Design Services Project Manager Mark Hoerstkamp at (573) 882-2957 or hoerstkampm@missouri.edu.

A prebid meeting will be held at 9:00 a.m., C.T., January 17, 2020 in the General Services Bldg., Rm 131, University of Missouri, Columbia, Missouri, followed by a walk-through at the site. All interested bidders are invited to attend this meeting. A walk-through of the project may be scheduled by contacting the Prebid Inspection Guide at (573) 882-2228 or mucfpmprebidinspectioonguides@missouri.edu. A 24 – 48 hour advance notice is required for all walk-through request.

Information regarding bid results will be available the day following the bid opening by calling (573) 882-1133

A Diversity Participation goal of 10% Combined MBE, WBE, DBE, Veteran and 3% SDVE has been established for this contract.

The Owner reserves the right to waive informalities in bids and to reject any and all bids.

Individuals with special needs as addressed by the Americans with Disabilities Act may contact (573) 882-1133.

Advertisement Date: January 14, 2020

Gary L. Ward
Vice Chancellor for Operations and Chief Operating Officer
University of Missouri
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SECTION 1.A

BID FOR LUMP SUM CONTRACT

Date:____________________________

BID OF
(hereinafter called "Bidder") a corporation* organized and existing under laws of the State of ________________________________,
a partnership* consisting of ________________________________,
an individual* trading as ________________________________,
a joint venture* consisting of ________________________________.

*Insert Corporation(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri
c/o Associate Vice Chancellor – Facilities
Room L100, General Services Building
University of Missouri
Columbia, Missouri 65211

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by Planning, Design, and Construction, entitled "Loeb Hall – Building Demolition", project number CP181011, dated January 14, 2020 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri’s tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. ___________________________ Dated ____________
Addendum No. ___________________________ Dated ____________
Addendum No. ___________________________ Dated ____________
Addendum No. ___________________________ Dated ____________

2. In following Bid(s), amount(s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.
3. BID PRICING

a. Base Bid:

The Bidder agrees to furnish all labor, materials, tools, and equipment required to completely demolish Loeb, disconnect all building utilities and provide site restoration. Additional work includes relocating utilities currently routing through Loeb including steam/steam condensate, chilled water supply/return, compressed air and campus energy management system. In addition, steam/steam condensate piping located within steam chase between existing steam utility hole [SMH-001] and Loeb shall be replaced; all as indicated on the Drawings and described in these Specifications for sum of: ___________________________ DOLLARS ($__________).  

b. Unit Prices:

(1) For changing specified quantities of work from those indicated by Contract Drawings and Specifications, upon written instructions of Owner, the following Unit Prices shall prevail in accordance with General Conditions.

(2) The following Unit Prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover all work.

(3) The following Unit Prices are required where applicable to particular Base Bid and/or Alternate being submitted.

(4) Only a single Unit Price shall be given and it shall apply for either MORE or LESS work than that indicated on Drawings and called for in Specifications as indicated to be included in Base Bid and/or Alternates. In the event that more or less units than so indicated is actually furnished, Change Orders will be issued for increased or decreased amounts as approved by the Owner.

(5) Bidder understands that the Owner will not be liable for any Unit Price or any amount in excess of Base Bid and any Alternate(s) accepted at time of award of Contract, except as expressed in written Change Orders duly executed and delivered by Owner's Representative.

(6) Removal of unsuitable material below subgrade of footings, utility trenches and utility tunnels, proper disposal of unsuitable material, and replacement with satisfactory materials when directed by the Geotechnical Engineer. NOTE: All excavation above subgrade is unclassified and shall be included in base bid. Subgrade is defined in
Section 312300. Base Bid quantity = 150 Cu. Yd. $_______/ cu.yd.

(7) Rock excavation below the subgrade of footings, utility trenches, and utility tunnels, proper disposal of excavated rock, and replacement with satisfactory materials. NOTE: All excavation above subgrade is unclassified and shall be included in base bid. Subgrade is defined in Section 312300.
Base Bid quantity = 75 Cu. Yd. $_______ / cu.yd.

(8) Repair of concrete cracks, per linear foot.
Base bid quantity = 20 linear feet. $_______/ LF

(9) Abatement and removal of underground 12" steam line with 20" exterior casing.
Base bid quantity = 185 linear feet. $_______/ LF.

(10) Abatement and removal of underground 6" condensate line with 10" exterior casing.
Base bid quantity = 185 linear feet. $_______/ LF.

4. PROJECT COMPLETION
   a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within one hundred twenty (120) calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.
   b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.
   c. Refer to Special Scheduling Requirements in Special Conditions for specific scheduling activities:

5. SUBCONTRACTOR LIST:
   Bidder hereby certifies that the following subcontractors will be used in performance of Work:
   NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List
name, city, and state of designated subcontractor, for each category of work listed
in Bid For Lump Sum Contract. If work within a category will be performed by more
than one subcontractor, Bidder shall provide name, city, and state of each
subcontractor and specify exact portion of work to be performed by each. If
acceptance/non-acceptance of Alternates will affect designation of a subcontractor,
Bidder shall provide information, for each affected category, with this bid form. If
Bidder intends to perform any designated subcontract work by using Bidder's own
employees, then Bidder shall list their own name, city, and state. The bidder may
petition the Owner to change a listed subcontractor only within 48 hours of the bid
opening. See Information For Bidders Section 16 List of Subcontractors for
requirements.

______________________________________________________________

Work to be performed Subcontractor Name, City, and State

__________________________________________________________________

Mechanical _______________________________________________________

Electrical _______________________________________________________  

Abatement _______________________________________________________  

Demolition _______________________________________________________  

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

a. The Contractor shall have as a goal, subcontracting with Minority Business
Enterprise (MBE) and with Women Business Enterprise (WBE), Disadvantage Business
Enterprise (DBE), and/or Veteran Owned Business of a combined ten percent (10%), and
Service Disabled Veteran Owned Business (SDVE) of three percent (3%) of awarded contract
price for work to be performed.

b. Requests for waiver of this goal shall be submitted on the attached
Application For Waiver form. A determination by the Director of Facilities Planning &
Development, UM, that a good faith effort has not been made by Contractor to achieve above stated
goal may result in rejection of bid.

c. The Undersigned proposes to perform work with following Supplier Diversity participation level:

MBE, WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION

___________________________________________ percent (_______%)

SDVE PERCENTAGE PARTICIPATION:

___________________________________________ percent (_______%)
d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS

a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.

b. Bidder agrees that bid shall not be withdrawn for a period of sixty (60) days after scheduled closing time for receipt of bids.

c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.

d. Accompanying the bid is a bid bond, or a certified check, or an irrevocable letter of credit, or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.

e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.

f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.
8. **BIDDER’S CERTIFICATE**

Bidder hereby certifies:

a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.

b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.

c. He has not solicited or induced any person, firm or corporation to refrain from bidding.

d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.

e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.

f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

**END OF BIDDER’S CERTIFICATE**
9. BIDDER’S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

<table>
<thead>
<tr>
<th>Authorized Signature</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td>Printed Name</td>
<td>Title</td>
</tr>
<tr>
<td>Company Name</td>
<td></td>
</tr>
<tr>
<td>Mailing Address</td>
<td></td>
</tr>
<tr>
<td>City, State, Zip</td>
<td></td>
</tr>
<tr>
<td>Phone No.</td>
<td>Federal Employer ID No.</td>
</tr>
<tr>
<td>Fax No.</td>
<td>E-Mail Address</td>
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<tr>
<td>Circle one: Individual Partnership Corporation Joint Venture</td>
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</tbody>
</table>

If a corporation, incorporated under the laws of the State of________

Licensed to do business in the State of Missouri? _____yes _____no

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

END OF SECTION
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**UNIVERSITY OF MISSOURI**  
**BIDDER'S STATEMENT OF QUALIFICATIONS**

Submit with Bid for Lump Sum Contract in separate envelope appropriately labeled. Attach additional sheet if necessary.

1. Company Name__________________________________________________________

   Phone# ___________________________ Fax #: ________________________________

   Address ________________________________________________________________

2. Number of years in business _____ If not under present firm name, list previous firm names and types of organization.

   _______________________________________________________________________

3. List contracts on hand (complete the following schedule, include telephone number).

<table>
<thead>
<tr>
<th>Project &amp; Address</th>
<th>Owner/Owner's Representative</th>
<th>Phone Number</th>
<th>Architect</th>
<th>Amount of your Contract</th>
<th>Percent Completed</th>
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4. General character of work performed by your company personnel.

   _______________________________________________________________________

5. List important projects completed in the last five (5) years on a type similar to the work now bid for, including approximate cost and telephone number.

<table>
<thead>
<tr>
<th>Project &amp; Address</th>
<th>Owner/Owner's Representative</th>
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6. Other experience qualifying you for the work now bid.

   _______________________________________________________________________

7. No default has been made in any contract complete or incomplete except as noted below:
   (a) Number of contracts on which default was made _______________________
   (b) Description of defaulted contracts and reason therefor

   _______________________________________________________________________

8. (a) Have you or your company participated in any contract subject to an equal opportunity clause similar to that described in the General Conditions?
   Yes _____ No _____
   
   (b) Have you filed all required compliance reports?
   Yes _____ No _____
(c) Is fifty percent or more of your company owned by a minority?  
Yes  ______  No  ______

(d) Is fifty percent or more of your company owned by a woman?  
Yes  ______  No  ______

(e) Is fifty percent or more of your company owned by a service disabled veteran?  
Yes  ______  No  ______

(f) Is fifty percent or more of your company owned by a veteran?  
Yes  ______  No  ______

(g) Is your company a Disadvantaged Business Enterprise?  
Yes  ______  No  ______

9. Have you or your company been suspended or debarred from working at any University of Missouri campus?  
   Yes  ______  No  ______ (If the answer is "yes", give details.)

10. Have any administrative or legal proceedings been started against you or your company alleging violation of any wage and hour regulations or laws?  
    Yes  ______  No  ______ (If the answer is "yes", give details.)

11. Workers Compensation Experience Modification Rates (last 3 yrs):  ______ / ______ / ______  

    Incidence Rates (last 3 years):  ______ / ______ / ______

12. List banking references.

13. (a) Do you have a current confidential financial statement on file with Owner?  
    Yes  ______  No  ______ (If not, and if desired, Bidder may submit such statement with bid, in a separate sealed and labeled envelope.)

    (b) If not, upon request will you file a detailed confidential financial statement within three (3) days?  
    Yes  ______  No  ______

Dated at ___________________________ this __________ day of ______________________ 20____

Name of Organization

__________________________________________________________

Signature

__________________________________________________________

Printed Name

__________________________________________________________

Title of Person Signing

END OF SECTION
UNIVERSITY OF MISSOURI  
BIDDER'S STATEMENT OF QUALIFICATIONS FOR ASBESTOS ABATEMENT

Submit with Bid for Lump Sum Contract in separate envelope appropriately labeled. Attach additional sheet if necessary.

1. Company Name_________________________Phone# ____________________

   Address _____________________________________________________________

2. State of Missouri Registration number______________________________

3. Number of years in business ______. If not under present firm name, list previous firm names and types of organization.

   ________________________________________________________________

4. List contracts on hand (complete the following schedule, include telephone number).

<table>
<thead>
<tr>
<th>Project &amp; Address</th>
<th>Owner/Owner's Representative</th>
<th>Phone Number</th>
<th>Architect</th>
<th>Amount of your Contract</th>
<th>Percent Completed</th>
</tr>
</thead>
</table>

   ________________________________________________________________

   ________________________________________________________________

5. General character of work performed by your company personnel.

   ________________________________________________________________

6. List important projects completed in the last five (5) years on a type similar to the work now bid for, including approximate cost and telephone number.

<table>
<thead>
<tr>
<th>Project &amp; Address</th>
<th>Owner/Owner's Representative</th>
<th>Phone Number</th>
<th>Architect</th>
<th>Amount of your Contract</th>
<th>Percent Completed</th>
</tr>
</thead>
</table>

   ________________________________________________________________

   ________________________________________________________________

7. Other experience qualifying you for the work now bid.

   ________________________________________________________________

8. No default has been made in any contract complete or incomplete except as noted below:

   (a) Number of contracts on which default was made ____________________

   (b) Description of defaulted contracts and reason therefor

   ________________________________________________________________

9. (a) Have you or your company participated in any contract subject to an equal opportunity clause similar to that described in the General Conditions?

   Yes _______ No _______

   (b) Have you filed all required compliance reports?

   Yes _______ No _______

BSQ/1  9/2016 Revision
(c) Is fifty percent or more of your company owned by a minority?  
Yes _____  No _____  
(d) Is fifty percent or more of your company owned by a woman?  
Yes _____  No _____  
(e) Is fifty percent or more of your company owned by a service disabled veteran?  
Yes _____  No _____  
(f) Is fifty percent or more of your company owned by a veteran?  
Yes _____  No _____  
(g) Is your company a Disadvantaged Business Enterprise?  
Yes _____  No _____

10. Have you or your company been suspended or debarred from working at any University of Missouri campus?  
Yes _____  No _____ (If the answer is "yes", give details.)

11. Have any administrative or legal proceedings been started against you or your company alleging violation of any wage and hour regulations or laws?  
Yes _____  No _____ (If the answer is "yes", give details.)

12. Workers Compensation Experience Modification Rates (last 3 yrs): _____ / _____ / _____  
Incidence Rates (last 3 years): _____ / _____ / _____

13. List banking references.

14. (a) Do you have a current confidential financial statement on file with Owner?  
Yes _____  No _____ (If not, and if desired, Bidder may submit such statement with bid, in a separate sealed and labeled envelope.)

(b) If not, upon request will you file a detailed confidential financial statement within three (3) days?  
Yes _____  No _____

Dated at ___________________________ this __________ day of ___________________ 20 _____

Name of Organization

______________________________
Signature

______________________________
Printed Name

______________________________
Title of Person Signing

END OF SECTION
SUPPLIER DIVERSITY COMPLIANCE EVALUATION FORM

This form shall be completed by Bidders and submitted with the Bidder's Statement of Qualifications form for each diverse firm who will function as a subcontractor on the contract.

The undersigned submits the following data with respect to this firm's assurance to meet the goal for Supplier Diversity participation.

I. Project:

II. Name of General Contractor:

III. Name of Diverse Firm:

Address:

Phone No.: Fax No.:

Status (check one) MBE WBE Veteran Service Disabled Veteran DBE

IV. Describe the subcontract work to be performed. (List Base Bid work and any Alternate work separately):

Base Bid: 

Alternate(s), (Identify separately):

V. Dollar amount of contract to be subcontracted to the Diverse firm:

Base Bid: 

Alternate(s), (Identify separately):

VI. Is the proposed subcontractor listed in the Directory of M/W/DBE Vendors, Directory of Serviced Disabled Veterans and/or the Directory of Veterans maintained by the State of Missouri?

Yes No
Is the proposed subcontractor certified as a diverse supplier by any of the following: federal government agencies, state agencies, State of Missouri city or county government agencies, Minority and/or WBE certifying agencies?

Yes ______  No ______  If yes, please provide details and attach a copy of the certification.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Does the proposed subcontractor have a signed document from their attorney certifying the Supplier as a Diverse and meeting the 51% owned and committed requirement?

Yes ______  No ______  If yes, please attach letter.

Signature: ________________________________________________________________

Name: __________________________________________________________________

Title: __________________________________________________________________

Date: ___________________________________________________________________
APPLICATION FOR WAIVER

This form shall be completed and submitted with the Bidder's Statement of Qualifications. Firms wishing to be considered for award are required to demonstrate that a good faith effort has been made to include diverse suppliers. This form will be used to evaluate the extent to which a good faith effort has been made. The undersigned submits the following data with respect to the firm's efforts to meet the goal for Supplier Diversity Participation.

1. List pre-bid conferences your firm attended where Supplier Diversity requirements were discussed.

2. Identify advertising efforts undertaken by your firm which were intended to recruit potential diverse subcontractors for various aspects of this project. Provide names of newspapers, dates of advertisements and copies of ads that were run.

3. Note specific efforts to contact in writing those diverse suppliers capable of and likely to participate as subcontractors for this project.

4. Describe steps taken by your firm to divide work into areas in which diverse suppliers/contractors would be capable of performing.

5. What efforts were taken to negotiate with prospective diverse suppliers/contractors for specific sub-bids? Include the names, addresses, and telephone numbers of diverse suppliers/contractors contacted, a description of the information given to diverse suppliers/contractors regarding plans and specifications for the assigned work, and a statement as to why additional agreements were not made with diverse suppliers/contractors.

6. List reasons for rejecting a diverse supplier/contractor which has been contacted.

SD/3
8. Describe the follow-up contacts with diverse suppliers/contractors made by your firm after the initial solicitation.


9. Describe the efforts made by your firm to provide interested diverse suppliers/contractors with sufficiently detailed information about the plans, specifications and requirements of the contract.


10. Describe your firm's efforts to locate diverse suppliers/contractors.


Based on the above stated good faith efforts made to include supplier diversity, the bidder hereby requests that the original supplier diversity percentage goal be waived and that the percentage goal for this project be set at ________ percent.


The undersigned hereby certifies, having read the answers contained in the foregoing Application for Waiver, that they are true and correct to the best of his/her knowledge, information and belief.

Signature

Name

Title

Company

Date
AFFIDAVIT

"The undersigned swears that the foregoing statements are true and correct and include all material information necessary to identify and explain the operation of ____________________________ (name of firm) as well as the ownership thereof. Further, the undersigned agrees to provide through the prime contractor or directly to the Contracting Officer current, complete and accurate information regarding actual work performed on the project, the payment therefore and any proposed changes, if any, of the project, the foregoing arrangements and to permit the audit and examination of books, records and files of the named firm. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under federal or state laws concerning false statements."

Note - If, after filing this information and before the work of this firm is completed on the contract covered by this regulation, there is any significant change in the information submitted, you must inform the Director of Facilities Planning and Development of the change either through the prime contractor or directly.

Signature

Name

Title

Date

Corporate Seal (where appropriate)

Date

State of

County of

On this ___________________ day of ____________________, 19_, before me appeared (name) _________________________ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm)

__________________________________________________________

____________________________ to execute the affidavit and did so as his or her own free act and deed.

(Seal)

Notary Public

Commission expires

SD/5
AFFIDAVIT FOR AFFIRMATIVE ACTION

State of Missouri  )
                  ) ss.
County of     )

_________________________________________ first being duly sworn on his/her oath states: that he/she is the (sole proprietor, partner, or officer) of __________________________________________________
_______________________ a (sole proprietorship, partnership, corporation), and as such (sole proprietor, partner, or officer) is
duly authorized to make this affidavit on behalf of said (sole proprietorship, partnership, corporation); that under the contract
known as "___________________________________________________________________________________________"
Project No. ________________ less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative
Action requirements as set forth in the "Nondiscrimination in Employment Equal Opportunity," Supplemental Special
Conditions, and Article 13 in the General Conditions do not apply.

_________________________________________

Subscribed and sworn before me this __________ day of __________________________, 19________

My commission expires _____________________________________________, 19________.
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CERTIFYING SUPPLIER DIVERSITY AGENCIES

Diverse firms are defined in General Conditions Articles 1.1.7 and those businesses must be certified as disadvantaged by an approved agency. The Bidder is responsible for obtaining information regarding the certification status of a firm. A list of certified firms may be obtained by contacting the agencies listed below. Any firm listed as disadvantaged by any of the following agencies will be classified as a diverse firm by the Owner.

St. Louis Development Corporation
1520 Market St., Ste. 2000
St. Louis, MO 63103
P: 314.982.1400
W: www.stlouis-mo.gov/sldc/

Bi-State Development
211 N. Broadway, Ste. 700
St. Louis, MO 63102
P: 314.982.1400
W: www.metrostlouis.dbesystem.com

St. Louis Minority Business Council
211 N. Broadway, Ste. 1300
St. Louis, MO 63102
P: 314.231.5555
W: www.slmbc.org

U.S. Small Business Administration - St. Louis, MO
8(a) Contractors, Minority Small Business
1222 Spruce Street, Suite 10.103
St. Louis, MO 63101
P: 314.539.6600
W: www.sba.gov

Lambert St. Louis International Airport
Business Diversity Development Office
11495 Navaid
Bridgeton, MO 63044
P: 314-426-8111

City of Kansas City, Missouri
Human Relations Department, MBE/WBE Division
4th Floor, City Hall
414 E. 12th Street
Kansas City, MO 64106
P: 816.513.1836
W: kcmohrd.mwdbce.com/?TN=kcmohrd

U.S. Small Business Administration - Kansas City, MO
8(a) Contractors, Minority Small Business
1000 Walnut, Suite 500
Kansas City, MO 64106
P: 816.426.4900
W: kcmohrd.mwdbce.com/?TN=kcmohrd

Missouri Department of Transportation
Division of Construction
1617 Missouri Blvd.
P.O. Box 270
Jefferson City, MO 65102
P: 573.526.2978
W: www.modot.org/mrcc-directory

Illinois Department of Transportation
MBE/WBE Certification Section
2300 Dirksen Parkway
Springfield, IL 62764
217/782-5490; 217/785-1524 (Fax)
W: webapps.dot.illinois.gov/UCP/ExternalSearch

State of Missouri OA
Office of Equal Opportunity
301 W. High St. HSC Rm 870-B
Jefferson City, MO 65101
P: 877.259.2963
W: oeo.mo.gov/
W: oeo.mo.gov/
Minority Newspapers

Dos Mundos Bilingual Newspaper
902A Southwest Blvd.
Kansas City, MO 64108
816-221-4747
www.dosmundos.com

Kansas City Hispanic News
2918 Southwest Blvd.
Kansas City, MO 64108
816/472-5246
www.kchispanicnews.com

The Kansas City Globe
615 E. 29th Street
Kansas City, MO 64109
816-531-5253
www.thekcglobe.com/about_us.php

St. Louis American
4144 Lindell
St. Louis, MO 63108
314-533-8000
www.stlamerican.com

St. Louis Chinese American News
1766 Burns Ave, Suite 201
St. Louis, MO 63132
314-432-3858
www.scannews.com

St. Louis Business Journal
815 Olive St., Suite 100
St. Louis, MO 63101
314-421-6200
www.bizjournal.com/stlouis

Kansas City Business Journal
1100 Main Street, Suite 210
Kansas City, MO 64105
816-421-5900
www.bizjournals.com/kansascity
AFFIDAVIT OF SUPPLIER DIVERSITY PARTICIPATION

The apparent low Bidder shall complete and submit this form within 48 hours of bid opening for each Diverse firm that will participate on the contract.

1. Diverse Firm: ________________________________
   Contact Name: ________________________________
   Address: ________________________________
   Phone No.: ________________________________ E-Mail: ________________________________
   Status (check one) MBE ☐ WBE ☐ Veteran ☐ Service Disabled Veteran ☐ DBE ☐
      If MBE, Certified as (circle one): 1) Black American 2) Hispanic American 3) Native American 4) Asian American

2. Is the proposed diverse firm certified by an approved agency [see IFB article 15]? Yes ☐ No ☐
   Agency: ________________________________ [attach copy of certification authorization from agency]
   Certification Number: ________________________________

3. Diverse firm scope work and bid/contract dollar amount of participation (List Base Bid and Alternate work separately). The final Dollar amount will be determined at substantial completion:

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Bid/Contract Amount</th>
<th>Final Dollar Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Bid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate #3</td>
<td></td>
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<tr>
<td>Alternate #4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate #5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate #6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The undersigned certifies that the information contained herein (i.e. Scope of Work and Bid/Contract Amount) is true and correct to the best of their knowledge, information and belief.

General Contractor: ________________________________ Diverse Firm: ________________________________
   Signature: ________________________________ Signature: ________________________________
   Name: ________________________________ Name: ________________________________
   Title: ________________________________ Title: ________________________________
   Date: ________________________________ Date: ________________________________

The undersigned certifies that the information contained herein (i.e. Scope of Work and Final Dollar Amount) is true and correct to the best of their knowledge, information and belief. If the Final Dollar Amount is different than the Bid/Contract Amount, then attach justification for the difference.

Contractor: ________________________________ Diverse Firm: ________________________________
   Signature: ________________________________ Signature: ________________________________
   Name: ________________________________ Name: ________________________________
   Title: ________________________________ Title: ________________________________
   Date: ________________________________ Date: ________________________________
### Information for Bidders

#### 1. Contract Documents

1. Drawings, specifications, and other contract documents, pursuant to work which is to be done, may be obtained shown in the Advertisement for Bids and Special Conditions.

#### 2. Bidder Obligations

2.1 Before submitting bids each bidder shall carefully examine the drawings and specifications and related contract documents, visit site of work and fully inform themselves as to all existing conditions, facilities, restrictions and other matters which can affect the work or the cost thereof.

2.2 Each bidder shall include in their bid the cost of all work and materials required to complete the contract in a first-class manner as hereinafter specified.

2.3 Failure or omission of any bidder to receive or examine any form, instrument, addendum, or other document, or to visit the site and acquaint themselves with existing conditions, shall in no way relieve them from any obligation with respect to their bid or contract, and no extra compensation will be allowed by reason of any thing or matter concerning which bidder should have fully informed themselves prior to bidding.

2.4 Submission of bids shall be deemed acceptance of the above obligations and each and every obligation required to be performed by all of the contract documents in the event the bid is accepted.

#### 3. Interpretation of Documents

3.1 If any prospective bidder is in doubt as to the true meaning of any part of the drawings and specifications or contract documents, they shall submit a written request to the Architect for an interpretation.

3.2 Requests for such interpretations shall be delivered to the Architect at least one (1) week prior to time for receipt of bids.

3.3 Bids shall be based only on interpretations issued in the form of addenda mailed to each person who is on the Architect's record as having received a set of the contract documents.

#### 4. Bids

4.1 Bids shall be received separately or in combination as shown in and required by the Bid for Lump Sum contract. Bids will be completed so as to include insertion of amounts for alternate bids, unit prices and cost accounting data.

4.2 Bidders shall apportion each base bid between various phases of the work, as stipulated in the Bid for Lump Sum contract. All work shall be done as defined in the specifications and as indicated on the drawings.

4.3 Bids shall be presented in sealed envelopes which shall be plainly marked "Bids for (indicate name of project from cover sheet)", and mailed or delivered to the building and room number specified in the Advertisement for Bids. Bidders shall be responsible for actual delivery of bids during business hours, and it shall not be sufficient to show that a bid was mailed in time to be received before scheduled closing time for receipt of bids, nor shall it be sufficient to show that a bid was somewhere in a university facility.

4.4 The bidder's price shall include all federal sales, excise, and similar taxes, which may be lawfully assessed in connection with their performance of work and purchase of materials to be incorporated in the work. City & State taxes shall not be included as defined within Article 3.16 of the General Conditions for Construction Contract included in the contract documents.

4.5 Bids shall be submitted on a single bid form, furnished by the Owner or Architect. Do not remove the bid form from the specifications.

4.6 No bidder shall stipulate in their bid any conditions not contained in the bid form.
4.7 The Owner reserves the right to waive informality in bids and to reject any or all bids.

5. Modification and Withdrawal of Bids
5.1 The bidder may withdraw their bid at any time before the scheduled closing time for receipt of bids, but no bidder may withdraw their bid after the scheduled closing time for receipt of bids.

5.2 Only telegrams, letters and other written requests for modifications or correction of previously submitted bids, contained in a sealed envelope which is plainly marked "Modification of Bid on (name of project on cover sheet)," which are addressed in the same manner as bids, and are received by Owner before the scheduled closing time for receipt of bids will be accepted and bids corrected in accordance with such written requests.

6. Signing of Bids
6.1 Bids which are signed for a partnership shall be manually signed in the firm name by at least one partner, or in the firm name by Attorney-in-Fact. If signed by Attorney-in-Fact there should be attached to the bid, a Power of Attorney evidencing authority to sign the bid dated the same date as the bid and executed by all partners of the firm.

6.2 Bids that are signed for a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written below corporate name. Title of office held by the person signing for the corporation shall appear below the signature of the officer.

6.3 Bids that are signed by an individual doing business under a firm name, shall be manually signed in the name of the individual doing business under the proper firm name and style.

6.4 Bids that are signed under joint venture shall be manually signed by officers of the firms having authority to sign for their firm.

7. Bid Security
7.1 Each bid shall be accompanied by a bid bond, certified check, or cashier's check, acceptable to and payable without condition to the Curators of the University of Missouri, in an amount at least equal to five percent (5%) of bidder's bid including additive alternates.

7.2 Bid security is required as a guarantee that bidder will enter into a written contract and furnish a performance bond within the time and in form as specified in these specifications; and if successful bidder fails to do so, the bid security will be realized upon or retained by the Owner. The apparent low bidder shall notify the Owner in writing within 48 hours (2 work days) of the bid opening of any circumstance that may affect the bid security including, but not limited to, a bidding error. This notification will not guarantee release of the bidder's security and/or the bidder from the Bidder's Obligations.

7.3 If a bid bond is given as a bid security, the amount of the bond may be stated as an amount equal to at least five percent (5%) of the bid, including additive alternates, described in the bid. The bid bond shall be executed by the bidder and a responsible surety licensed in the State of Missouri with a Best’s rating of no less than A-/.XI.

7.4 It is specifically understood that the bid security is a guarantee and shall not be considered as liquidated damages for failure of bidder to execute and deliver their contract and performance bond, nor limit or fix bidder's liability to Owner for any damages sustained because of failure to execute and deliver the required contract and performance bond.

7.5 Bid security of the two (2) lowest and responsive Bidders will be retained by the Owner until a contract has been executed and an acceptable bond has been furnished, as required hereby, when such bid security will be returned. Surety bonds of all other bidders will be destroyed and all other alternative forms of bid bonds will be returned to them within ten (10) days after Owner has determined the two (2) lowest and responsive bids.

8. Bidder's Statement of Qualifications
8.1 Each bidder submitting a bid shall present evidence of their experience, qualifications, financial responsibility and ability to carry out the terms of the contract by completing and submitting with their bid the schedule of information set forth in the form furnished in the bid form.

8.2 Such information, a single copy required in a separate sealed envelope, will be treated as confidential information by the Owner, within the meaning of Missouri Statute 610.010.

8.3 Bids not accompanied with current Bidder's Statement of Qualifications may be rejected.

9. Award of Contract
9.1 The Owner reserves the right to let other contracts in connection with the work, including, but not by way of limitation, contracts for furnishing and installation of furniture, equipment, machines, appliances, and other apparatus.

9.2 In awarding the contract, the Owner may take into consideration the bidder's, and their subcontractor's, ability to handle promptly the additional work, skill, facilities, capacity, experience, ability, responsibility, previous work, financial standing of bidder, and the bidder's ability to provide the required bonds and insurance; quality, efficiency and construction of equipment proposed to be furnished; period of time within which equipment is proposed to be furnished and delivered; success in achieving the specified Supplier Diversity goal, or demonstrating a good faith effort as described in Article 15; necessity of prompt and efficient completion of work herein described, and the bidder's status as suspended or debarred. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of their bid.

10. Contract Execution
10.1 The Contractor shall submit within fifteen (15) days from receipt of notice, the documents required in Article 9 of the General Conditions for Construction Contract included in the contract documents.
10.2 No bids will be considered binding upon the Owner until the documents listed above have been furnished. Failure of Contractor to execute and submit these documents within the time period specified will be treated, at the option of the Owner, as a breach of the bidder's bid security under Article 7 and the Owner shall be under no further obligation to Bidder.

11. Contract Security

11.1 When the Contract sum exceeds $50,000, the Contractor shall procure and furnish a Performance bond and a Payment bond in the form prepared by Owner. Each bond shall be in the amount equal to one hundred percent (100%) of the contract sum, as well as adjustments to the Contract Sum. The Performance Bond shall secure and guarantee Contractor’s faithful performance of this Contract, including but not limited to Contractor’s obligation to correct defects after final payment has been made as required by the Contract Documents. The Payment Bond shall secure and guarantee payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. These Bonds shall be in effect through the duration of the Contract plus the Guaranty Period as required by the Contract Documents.

11.2 The bonds required hereunder shall be meet all requirements of Article 11 of the General Conditions for Construction Contract included in the contract documents.

11.3 If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to conduct business in the State of Missouri is terminated, or it ceases to make such substitution, Owner may procure such required bonds on behalf of Contractor at Contractor’s expense.

12. Time of Completion

12.1 Contractors shall agree to commence work within five (5) days of the date “Notice to Proceed” is received from the Owner, and the entire work shall be completed by the completion date specified or within the number of consecutive calendar days stated in the Special Conditions. The duration of the construction period, when specified in consecutive calendar days, shall begin when the contractor receives notice requesting the documents required in Article 9 of the General Conditions for Construction Contract included in the contract documents.

13. Number of Contract Documents

13.1 The Owner will furnish the Contractor a copy of the executed contract and performance bond.

13.2 The Owner will furnish the Contractor the number of copies of complete sets of drawings and specifications for the work, as well as, clarification and change order drawings pertaining to change orders required during construction as set forth in the Special Conditions.

14. Missouri Products and Missouri Firms

14.1 The Curators of the University of Missouri have adopted a policy which is binding upon all employees and departments of the University of Missouri, and which by contract, shall be binding upon independent contractors and subcontractors with the University of Missouri whereby all other things being equal, and when the same can be secured without additional cost over foreign products, or products of other states, a preference shall be granted in all construction, repair and purchase contracts, to all products, commodities, materials, supplies and articles mined, grown, produced and manufactured in marketable quantity and quality in the State of Missouri, and to all firms, corporations or individuals doing business as Missouri firms, corporations or individuals. Each bidder submitting a bid agrees to comply with, and be bound by the foregoing policy.

15. SUPPLIER DIVERSITY

15.1 Award of Contract

The Supplier Diversity participation goal for this project is stated on the Bid for Lump Sum Contract Form, and the Owner will take into consideration the bidder's success in achieving the Supplier Diversity participation goal in awarding the contract. Inability of any bidder to meet this requirement may be cause for rejection of their bid.

The University will grant a three (3) point bonus preference to a Missouri based, certified Service Disabled Veteran Enterprise (SDVE) bidder as defined in Article 1 – (Supplier Diversity Definitions) of the General Conditions of the Contract for Construction included in the contract documents. The three percent (3%) goal can be met, and the bonus points obtained, by a qualified SDVE vendor and/or through the use of qualified subcontractors or suppliers that provide at least three percent (3%) of the total contract value.

15.2 List of Supplier Diversity Firms

15.2.1 The bidder shall submit as part of their bid a list of diverse firms performing as contractor, subcontractors, and/or suppliers. The list shall specify the single designated diverse firm name and address. If acceptance or non-acceptance of alternates will affect the designation of a subcontractor, provide information for each affected category.

15.2.2 Failure to include a complete list of diverse firms may be grounds for rejection of the bid.

15.2.3 The list of diverse firms shall be submitted in addition to any other listing of subcontractors required in the Bid for Lump Sum Contract Form.

15.3 Supplier Diversity Percentage Goal

The bidder shall have a minimum goal of subcontracting with diverse contractors, subcontractors, and suppliers, the percent of contract price stated in the Supplier Diversity goal paragraph of the Bid for Lump Sum Contract Form.

15.4 Supplier Diversity Percent Goal Computation

15.4.1 The total dollar value of the work granted to the diverse firms by the successful bidder is counted towards the applicable goal of the entire contract, unless otherwise noted below.

15.4.2 The bidder may count toward the Supplier Diversity goal only expenditures to diverse firms that perform a commercially useful function in the work of a contract. A diverse firm is considered to perform a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by
actually performing, managing and supervising the work involved. A bidder that is a certified diverse firm may count as 100% of the contract towards the Supplier Diversity goal. For projects with separate MBE, SDVE, and WBE/Veteran/DBE goals, a MBE firm bidding as the prime bidder is expected to obtain the required SDVE, and WBE/Veteran/DBE participation; a WBE or Veteran or DBE firm bidding as the prime bidder is expected to obtain the required MBE and SDVE participation and a SDVE firm bidding as the prime bidder is expected to obtain the required MBE, and WBE/Veteran/DBE participation.

15.4.3 When a MBE, WBE, Veteran Business Enterprise, DBE, or SDVE performs work as a participant in a joint venture, only the portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work of the contract that the MBE, WBE, Veteran Business Enterprise, DBE, or SDVE performs with its own forces shall count toward the MBE, WBE, Veteran Business Enterprise, DBE, or SDVE individual contract percentages.

15.4.4 The bidder may count toward its Supplier Diversity goal expenditures for materials and supplies obtained from diverse suppliers and manufacturers, provided the diverse firm assumes the actual and contractual responsibility for the provision of the materials and supplies.

15.4.4.1 The bidder may count its entire expenditure to a diverse manufacturer. A manufacturer shall be defined as an individual or firm that produces goods from raw materials or substantially alters them before resale.

15.4.4.2 The bidder may count its entire expenditure to diverse suppliers that are not manufacturers provided the diverse supplier performs a commercially useful function as defined above in the supply process.

15.4.4.3 The bidder may count 25% of its entire expenditures to diverse firms that do not meet the definition of a subcontractor, a manufacturer, nor a supplier. Such diverse firms may arrange for, expedite, or procure portions of the work but are not actively engaged in the business of performing, manufacturing, or supplying that work.

15.4.5 The bidder may count toward the Supplier Diversity goal that portion of the total dollar value of the work awarded to a certified joint venture equal to the percentage of the ownership and control of the diverse partner in the joint venture.

15.4.6 On projects with separate MBE and WBE/Veteran/DBE goals, the Owner may allow MBE participation provided in excess of the MBE goal to be counted towards the WBE/Veteran/DBE goal.

15.5 Certification by Bidder of Diverse Firms

15.5.1 The bidder shall submit with its bid the information requested in the "Supplier Diversity Compliance Evaluation Form" for every diverse firm the bidder intends to award work to on the contract.

15.5.2 Diverse firms are defined in Article 1 – (Supplier Diversity Definitions) of the General Conditions of the Contract for Construction included in the contract documents, and as those businesses certified as disadvantaged by an approved agency. The bidder is responsible for obtaining information regarding the certification status of a firm. A list of certified firms may be obtained by contacting the agencies listed in the proposal form document “Supplier Diversity Certifying Agencies”. Any firm listed as disadvantaged by any of the identified agencies will be classified as a diverse firm by the Owner.

15.5.3 Bidders are urged to encourage their prospective diverse contractors, subcontractors, joint venture participants, team partners, and suppliers who are not currently certified to obtain certification from one of the approved agencies.

15.6 Supplier Diversity Participation Waiver

15.6.1 The bidder is required to make a good faith effort to locate and contract with diverse firms. If a bidder has made a good faith effort to secure the required diverse firms and has failed, the bidder shall submit with the bid, the information requested in "Application for Supplier Diversity Participation Waiver." The Contracting Officer will review the bidder's actions as set forth in the bidder's "Application for Waiver" and any other factors deemed relevant by the Contracting Officer to determine if a good faith effort has been made to meet the applicable percentage goal. If the bidder is judged not to have made a good faith effort, the bid may be rejected. Bidder's who demonstrate that they have made a good faith effort to include Supplier Diversity participation may be awarded the contract regardless of the percent of Supplier Diversity participation, provided the bid is otherwise acceptable and is determined to be the best bid.

15.6.2 To determine good faith effort of the bidder, the Contracting Officer may evaluate factors including, but not limited to, the following:

15.6.2.1 The bidder’s attendance at pre-proposal meetings scheduled to inform bidders and diverse firms of contracting and subcontracting opportunities and responsibilities associated with Supplier Diversity participation.

15.6.2.2 The bidder’s advertisements in general circulation trade association, and diverse (minority) focused media concerning subcontracting opportunities.

15.6.2.3 The bidder’s written notice to specific diverse firms that their services were being solicited in sufficient time to allow for their effective participation.

15.6.2.4 The bidder’s follow-up attempts to the initial solicitation(s) to determine with certainty whether diverse firms were interested.

15.6.2.5 The bidder’s efforts to divide the work into packages suitable for subcontracting to diverse firms.

15.6.2.6 The bidder’s efforts to provide interested diverse firms with sufficiently detailed information about the drawings, specific actions and requirements of the contract, and clear scopes of work for the firms to bid on.
15.6.2.7  The bidder’s efforts to solicit for specific sub-bids from diverse firms in good faith. Documentation should include names, addresses, and telephone numbers of firms contacted a description of all information provided the diverse firms, and an explanation as to why agreements were not reached.

15.6.2.8  The bidder's efforts to locate diverse firms not on the directory list and assist diverse firms in becoming certified as such.

15.6.2.9  The bidder's initiatives to encourage and develop participation by diverse firms.

15.6.2.10 The bidder’s efforts to help diverse firms overcome legal or other barriers impeding the participation of diverse firms in the construction contract.

15.6.2.11 The availability of diverse firms and the adequacy of the bidder's efforts to increase the participation of such business provided by the persons and organizations consulted by the bidder.

15.7  Submittal of Forms
15.7.1 The bidder will include the Supplier Diversity Compliance Evaluation Form(s), or the Application for Waiver and other form(s) as required above in the envelope containing the "Bidder's Statement of Qualifications", see Article 8.

15.8  Additional Bid/Proposer Information
15.8.1 The Contracting Officer reserves the right to request additional information regarding Supplier Diversity participation and supporting documentation from the apparent low bidder. The bidder shall respond in writing to the Contracting Officer within 24-hours (1 work day) of a request.

15.8.2 The Contracting Officer reserves the right to request additional information after the bidder has responded to prior 24 hour requests. This information may include follow up and/or clarification of the information previously submitted.

15.8.3 The Owner reserves the right to consider additional diverse subcontractor and supplier participation submitted by the bidder after bids are opened under the provisions within these contract documents that describe the Owner’s right to accept or reject subcontractors including, but not limited to, Article 16 below. The Owner may elect to waive the good faith effort requirement if such additional participation achieves the Supplier Diversity goal.

15.8.4 The Bidder shall provide the Owner information related to the Supplier Diversity participation included in the bidder’s proposal, including, but is not limited to, the complete Application for Waiver, evidence of diverse certification of participating firms, dollar amount of participation of diverse firms, information supporting a good faith effort as described in Article 15.6 above, and a list of all diverse firms that submitted bids to the Bidder with the diverse firm’s price and the name and the price of the firm awarded the scope of work bid by the diverse firm.

16.  List of Subcontractors
16.1 If a list of subcontractors is required on the Bid for Lump Sum Contract Form, the bidders shall list the name, city and state of the firm(s) which will accomplish that portion of the contract requested in the space provided. This list is separate from both the list of diverse firms required in Article 15.2, and the complete list of subcontractors required in Article 10.1 of this document. Should the bidder choose to perform any of the listed portions of the work with its own forces, the bidder shall enter its own name, city and state in the space provided. If acceptance or non-acceptance of alternates will affect the designation of a subcontractor, the bidder shall provide that information on the bid form.

16.2 Failure of the bidder to supply the list of subcontractors required or the listing of more than one subcontractor for any category without designating the portion of the work to be performed by each, shall be grounds for the rejection of the bid. The bidder can petition the Owner to change a listed subcontractor within 48 hours of the bid opening. The Owner reserves the right to make the final determination on a petition to change a subcontractor. The Owner will consider factors such as clerical and mathematical bidding errors, listed subcontractor’s inability to perform the work for the bid used, etc. Any request to change a listed subcontractor shall include at a minimum, contractor’s bid sheet showing tabulation of the bid; all subcontractor bids with documentation of the time they were received by the contractor; and a letter from the listed subcontractor on their letterhead stating why they cannot perform the work if applicable. The Owner reserves the right to ask for additional information.

16.3 Upon award of the contract, the requirements of Article 10 of this document and Article 5 of the General Conditions of the Contract for Construction included in the contract documents will apply.
14. TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 Termination by Owner for Cause

14.2 Suspension by the Owner for Convenience

14.3 Owner’s Termination for Convenience
ARTICLE 1
GENERAL PROVISIONS

1.1 Basic Definitions
As used in the Contract Documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1.1.1 Owner
The Curators of the University of Missouri. The Owner may act through its Board of Curators or any duly authorized committee or representative thereof.

1.1.2 Contracting Officer
The Contracting Officer is the duly authorized representative of the Owner with the authority to execute contracts. Communications to the Contracting Officer shall be forwarded via the Owner's Representative.

1.1.3 Owner's Representative
The Owner’s Representative is authorized by the Owner as the administrator of the Contract and will represent the Owner during the progress of the Work. Communications from the Architect to the Contractor and from the Contractor to the Architect shall be through the Owner's Representative, unless otherwise indicated in the Contract Documents.

1.1.4 Architect
When the term "Architect" is used herein, it shall refer to the Architect or the Engineer specified and defined in the Contract for Construction or its duly authorized representative. Communications to the Architect shall be forwarded to the address shown in the Contract for Construction.

1.1.5 Contractor
The Contractor is the person or entity with whom the Owner has entered into the Contract for Construction. The term “Contractor” means the Contractor or the Contractor’s authorized representative.

1.1.6 Subcontractor and Lower-tier Subcontractor
A Subcontractor is a person or organization who has a contract with the Contractor to perform any of the Work. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or its authorized representative. The term "Subcontractor" also is applicable to those furnishing materials to be incorporated in the Work whether work performed is at the Owner’s site or off site, or both. A lower-tier Subcontractor is a person or organization who has a contract with a Subcontractor or another lower-tier Subcontractor to perform any of the Work at the site. Nothing contained in the Contract Documents shall create contractual relationships between the Owner or the Architect and any Subcontractor or lower-tier Subcontractor of any tier.

1.1.7 Supplier Diversity Definitions
Businesses that fall into the Supplier Diversity classification shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more diverse suppliers as described below.

.1 Minority Business Enterprises (MBE)
Minority Business Enterprise [MBE] shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more minorities as defined below or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more minorities as defined below, and whose management and daily business operations are controlled by one (1) or more minorities as defined herein.

.1.1 "African Americans", which includes persons having origins in any of the black racial groups of Africa.

.1.2 "Hispanic Americans", which includes persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

.1.3 "Native Americans", which includes persons of American Indian, Eskimo, Aleut, or Native Hawaiian origin.

.1.4 "Asian-Pacific Americans", which includes persons whose origins are from Japan, China, Taiwan, Korea, Vietnam, Laos, Cambodia, the Philippines, Samoa, Guam, the U.S. Trust Territories of the Pacific, or the Northern Marinas.

.1.5 "Asian-Indian Americans", which includes persons whose origins are from India, Pakistan, or Bangladesh.

.2 Women Business Enterprise (WBE)
Women Business Enterprise [WBE] shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more women or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more women, and whose management and daily business operations are controlled by one (1) or more women.

.3 Veteran Owned Business
Veteran Owned Business shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more Veterans or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more Veterans, and whose management and daily business operations are controlled by one (1) or more Veterans. Veterans must be certified by the appropriate federal agency responsible for veterans’ affairs.

.4 Service Disabled Veteran Enterprise (SDVE)
Service Disabled Veteran Enterprise (SDVE) shall mean a business certified by the State of Missouri Office of Administration as a Service Disabled Veteran Enterprise, which is at least fifty-one percent (51%) owned and controlled by one (1) or more Serviced Disabled Veterans or,
in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more Service Disabled Veterans, and whose management and daily business operations are controlled by one (1) or more Service Disabled Veterans.

.5 Disadvantaged Business Enterprise (DBE)

A Disadvantaged Business Enterprise (DBE) is a for-profit small business concern where a socially and economically disadvantaged individual owns at least 51% interest and also controls management and daily business operations. These firms can and also be referred to as Small Disadvantaged Businesses (SDB). Eligibility requirements for certification are stated in 49 CFR (Code of Federal Regulations), part 26, Subpart D.

U.S. citizens that are African-Americans, Hispanics, Native Americans, Asian-Pacific and Subcontinent Asian Americans, and women are presumed to be socially and economically disadvantaged. Also recognized as DBE’s are Historically Black Colleges and Universities (HBCU) and small businesses located in Federal HUB Zones.

To be regarded as economically disadvantaged, an individual must have a personal net worth that does not exceed $1.32 million. To be seen as a small business, a firm must meet Small Business Administration (SBA) size criteria (500 employees or less) and have average annual gross receipts not to exceed $22.41 million. To be considered a DBE/SDB, a small business owned and controlled by socially and/or economically disadvantaged individuals must receive DBE certification from one of the recognized Missouri state agencies to be recognized in this classification.

1.1.9 Work

Work shall mean supervision, labor, equipment, tools, material, supplies, incidentals operations and activities required by the Contract Documents or reasonably inferable by Contractor therefrom as necessary to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.

1.1.10 Approved

The terms "approved", "equal to", "directed", "required", "ordered", "designated", "acceptable", "satisfactory", and similar words or phrases will be understood to have reference to action on the part of the Architect and/or the Owner's Representative.

1.1.11 Contract Documents

The Contract Documents consist of (1) the executed Contract for Construction, (2) these General Conditions of the Contract for Construction, (3) any Supplemental Conditions or Special Conditions identified in the Contract for Construction, (4) the Specifications identified in the Contract for Construction, (5) the Drawings identified in the Contract for Construction, (6) Addenda issued prior to the receipt of bids, (7) Contractor’s bid addressed to Owner, including Contractor’s completed Qualification Statement, (8) Contractor’s Performance Bond and Contractor’s Payment Bond, (9) Notice to Proceed, (10) and any other exhibits and/or post bid adjustments identified in the Contract for Construction, (11) Advertisement for Bid, (12) Information for Bidders, and (13) Change Orders issued after execution of the Contract. All other documents and technical reports and information are not Contract Documents, including without limitation, Shop Drawings, and Submittals.

1.1.12 Contract

The Contract Documents form the Contract and are the exclusive statement of agreement between the parties. The Contract represents the entire and integrated agreement between the parties hereeto and supersedes prior representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Owner and a Subcontractor or any lower-tier Sub subcontractor.

1.1.13 Change Order

The Contract may be amended or modified without invalidating the Contract, only by a Change Order, subject to the limitations in Article 7 and elsewhere in the Contract Documents. A Change Order is a written instrument signed by the Owner and the Contractor stating their agreement to a change in the Work, the amount of the adjustment to the Contract Sum, if any, and the extent of the adjustment to the Contract Time, if any. Agreement to any Change Order shall constitute a final settlement of all matters relating to the change in the work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments of the Contract sum, time and schedule.

1.1.14 Substantial Completion

The terms “Substantial Completion” or "substantially complete" as used herein shall be construed to mean the completion of the entire Work, including all submittals required under the Contract Documents, except minor items which in the opinion of the Architect, and/or the Owner's Representative will not interfere with the complete and satisfactory use of the facilities for the purposes intended.

1.1.15 Final Completion

The date when all punch list items are completed, including all closeout submittals and approval by the Architect is given to the Owner in writing.

1.1.16 Supplemental and Special Conditions
The terms “Supplemental Conditions” or “Special Conditions” shall mean the part of the Contract Documents which amend, supplement, delete from, or add to these General Conditions.

1.1.17 Day
The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

1.1.18 Knowledge.
The terms “knowledge,” “recognize” and “discover,” their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows or should know, recognizes or should recognize and discovers or should discover in exercising the care, skill, and diligence of a diligent and prudent contractor familiar with the work. Analogously, the expression “reasonably inferable” and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a diligent and prudent contractor familiar with the work.

1.1.19 Punch List
“Punch List” means the list of items, prepared in connection with the inspection of the Project by the Owner’s Representative or Architect in connection with Substantial Completion of the Work or a portion of the Work, which the Owner’s Representative or Architect has designated as remaining to be performed, completed or corrected before the Work will be accepted by the Owner.

1.1.20 Public Works Contracting Minimum Wage
The public works contracting minimum wage shall be equal to one hundred twenty percent of the average hourly wage in a particular locality, as determined by the Missouri economic research and information center within the department of economic development, or any successor agency.

1.2 Specifications and Drawings
1.2.1 The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction system, standards and workmanship and performance of related services for the Work identified in the Contract for Construction. Specifications are separated into titled divisions for convenience of reference only. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Such separation will not operate to make the Owner or the Architect an arbiter of labor disputes or work agreements.

1.2.2 The drawings herein referred to, consist of drawings prepared by the Architect and are enumerated in the Contract Documents.

1.2.3 Drawings are intended to show general arrangements, design, and dimensions of work and are partly diagrammatic. Dimensions shall not be determined by scale or rule. If figured dimensions are lacking, they shall be supplied by the Architect on the Contractor's written request to the Owner's Representative.

1.2.4 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complimentary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.2.5 In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; either or both in accordance with the Owner’s Representative’s interpretation. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings. Before ordering any materials or doing any Work, the Contractor and each Subcontractor shall verify measurements at the Work site and shall be responsible for the correctness of such measurements. Any difference which may be found shall be submitted to the Owner’s Representative and Architect for resolution before proceeding with the Work. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such change for the approval by the Owner’s Representative and Architect before making the change.

1.2.6 Data in the Contract Documents concerning lot size, ground elevations, present obstructions on or near the site, locations and depths of sewers, conduits, pipes, wires, etc., position of sidewalks, curbs, pavements, etc., and nature of ground and subsurface conditions have been obtained from sources the Architect believes reliable, but the Architect and Owner do not represent or warrant that this information is accurate or complete. The Contractor shall verify such data to the extent possible through normal construction procedures, including but not limited to contacting utility owners and by prospecting.

1.2.7 Only work included in the Contract Documents is authorized, and the Contractor shall do no work other than that described therein.
1.2.8 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. Contractor represents that it has performed its own investigation and examination of the Work site and its surroundings and satisfied itself before entering into this Contract as to:

.1 conditions bearing upon transportation, disposal, handling, and storage of materials;
.2 the availability of labor, materials, equipment, water, electrical power, utilities and roads;
.3 uncertainties of weather, river stages, flooding and similar characteristics of the site;
.4 conditions bearing upon security and protection of material, equipment, and Work in progress;
.5 the form and nature of the Work site, including the surface and sub-surface conditions;
.6 the extent and nature of Work and materials necessary for the execution of the Work and the remediating of any defects therein; and
.7 the means of access to the site and the accommodations it may require and, in general, shall be deemed to have obtained all information as to risks, contingencies and other circumstances.
.8 the ability to complete work without disruption to normal campus activities, except as specifically allowed in the contract documents.

The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.

1.2.9 Drawings, specifications, and copies thereof furnished by the Owner are and shall remain the Owner's property. They are not to be used on another project and, with the exception of one contract set for each party to the Contract, shall be returned to the Owner's Representative on request, at the completion of the Work.

1.3 Required Provisions Deemed Inserted
Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein; and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the written application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

ARTICLE 2
OWNER

2.1 Information and Services Required of the Owner
2.1.1 Permits and fees are the responsibility of the Contractor under the Contract Documents, unless specifically stated in the contract documents that the Owner will secure and pay for specific necessary approvals, easements, assessments, and charges required for construction, use or occupancy of permanent structures, or for permanent changes in existing facilities.

2.1.2 When requested in writing by the Contractor, information or services under the Owner's control, which are reasonably necessary to perform the Work, will be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.

2.2 Owner's Right to Stop the Work
2.2.1 If the Contractor fails to correct Work which is not in strict accordance with the requirements of the Contract Documents or fails to carry out Work in strict accordance with the Contract Documents, the Owner's Representative may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work will not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. Owner’s lifting of Stop Work Order shall not prejudice Owner’s right to enforce any provision of this Contract.

2.3 Owner's Right to Carry Out the Work
2.3.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a seven (7) day period after receipt of a written notice from the Owner to correct such default or neglect, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect’s additional services and expenses made necessary by such default or neglect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to Owner. However, such notice shall be waived in the event of an emergency with the potential for property damage or the endangerment of students, faculty, staff, the public or construction personnel, at the sole discretion of the Owner.

2.3.2 In the event the Contractor has not satisfactorily completed all items on the Punch List within thirty (30) days of its receipt, the Owner reserves the right to complete the Punch List without further notice to the Contractor or its
2.4 Extent of Owner Rights
2.4.1 The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

2.4.2 In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.

ARTICLE 3
CONTRACTOR

3.1 Contractor's Warranty
3.1.1 The Contractor warrants all equipment and materials furnished, and work performed, under this Contract, against defective materials and workmanship for a period of twelve months after acceptance as provided in this Contract, unless a longer period is specified, regardless of whether the same were furnished or performed by the Contractor or any Subcontractors of any tier. Upon written notice from the Owner of any breach of warranty during the applicable warranty period due to defective material or workmanship, the affected part or parts thereof shall be repaired or replaced by the Contractor at no cost to the Owner. Should the Contractor fail or refuse to make the necessary repairs, replacements, and tests when requested by the Owner, the Owner may perform, or cause the necessary work and tests to be performed, at the Contractor's expense, or exercise the Owner's rights under Article 14.

3.1.2 Should one or more defects mentioned above appear within the specified period, the Owner shall have the right to continue to use or operate the defective part or apparatus until the Contractor makes repairs or replacements or until such time as it can be taken out of service without loss or inconvenience to the Owner.

3.1.3 The above warranties are not intended as a limitation, but are in addition to all other express warranties set forth in this Contract and such other warranties as are implied by law, custom, and usage of trade. The Contractor, and its surety or sureties, if any, shall be liable for the satisfaction and full performance of the warranties set forth herein.

3.1.4 Neither the final payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner, nor expiration of warranty stated herein, will constitute an acceptance of Work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any responsibility for non-conforming work. The Contractor shall immediately remedy any defects in the Work and pay for any damage to other Work resulting therefrom upon written notice from the Owner. Should the Contractor fail or refuse to remedy the non-conforming work, the Owner may perform, or cause to be performed the work necessary to bring the work into conformance with the Contract Documents at the Contractor's expense.

3.1.5 The Contractor agrees to defend, indemnify, and save harmless The Curators of the University of Missouri, their Officers, Agents, Employees and Volunteers, from and against all loss or expense from any injury or damages to property of others suffered or incurred on account of any breech of the aforesaid obligations and covenants. The Contractor agrees to investigate, handle, respond to and provide defense for and defend against any such liability, claims, and demands at the sole expense of the Contractor, or at the option of the University, agrees to pay to or reimburse the University for the defense costs incurred by the University in connection with any such liability claims, or demands. The parties hereto understand and agree that the University is relying on, and does not waive or intend to waive by any provision of this Contract, any monetary limitations or any other rights, immunities, and protections provided by the State of Missouri, as from time to time amended, or otherwise available to the University, or its officers, employees, agents or volunteers.

3.2 Compliance with Laws, Permits, Regulations and Inspections
3.2.1 The Contractor shall, without additional expense to the Owner, comply with all applicable laws, ordinances, rules, statutes, and regulations (collectively referred to as “Laws”).

3.2.2 Since the Owner is an instrumentality of the State of Missouri, municipal, or political subdivision, ordinances, zoning ordinances, and other like ordinances are not applicable to construction on the Owner's property, and the Contractor will not be required to submit plans and specifications to any municipal or political subdivision authority to obtain construction permits or any other licenses or permits from or submit to, inspection by any municipality or political subdivision relating to the construction on the Owner's property, unless required by the Owner in these Contract Documents or otherwise in writing.
3.2.3 All fees, permits, inspections, or licenses required by municipality or political subdivision for operation on property not belonging to the Owner, shall be obtained by and paid for by the Contractor. The Contractor, of its own expense, is responsible to ensure that all inspections required by said permits or licenses on property, easements, or utilities not belonging to the Owner are conducted as required therein. All connection charges, assessments or transportation fees as may be imposed by any utility company or others are included in the Contract Sum and shall be the Contractor’s responsibility, as stated in 2.1.1 above.

3.2.4 If the Contractor has knowledge that any Contract Documents are at variance with any Laws, including Americans with Disabilities Act – Standards for Accessible Design, ordinances, rules, regulations or codes applying to the Work, Contractor shall promptly notify the Architect and the Owner’s Representative, in writing, and any necessary changes will be adjusted as provided in Contract Documents. However, it is not the Contractor’s primary responsibility to ascertain that the Contract Documents are in accordance with applicable Laws, unless such Laws bear upon performance of the Work.

3.3 Anti-Kickback

3.3.1 No member or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

3.3.2 No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply contract or any Subcontract of any tier in connection with the construction of the Work shall have a financial interest in this Contract or in any part thereof, any material supply contract, Subcontract of any tier, insurance contract, or any other contract pertaining to the Work.

3.4 Supervision and Construction Procedures

3.4.1 The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract. The Contractor shall supply sufficient and competent supervision and personnel, and sufficient material, plant, and equipment to prosecute the Work with diligence to ensure completion thereof within the time specified in the Contract Documents, and shall pay when due any laborer, Subcontractor of any tier, or supplier.

3.4.2 The Contractor, if an individual, shall give the Work an adequate amount of personal supervision, and if a partnership or corporation or joint venture the Work shall be given an adequate amount of personal supervision by a partner or executive officer, as determined by the Owner's Representative.

3.4.3 The Contractor and each of its Subcontractors of any tier shall submit to the Owner such schedules of quantities and costs, progress schedules in accordance with 3.17.2 of this document, payrolls, reports, estimates, records, and other data as the Owner may request concerning Work performed or to be performed under the Contract.

3.4.4 The Contractor shall be represented at the site by a competent superintendent from the beginning of the Work until its final acceptance, whenever contract work is being performed, unless otherwise permitted in writing by the Owner's Representative. The superintendent for the Contractor shall exercise general supervision over the Work and such superintendent shall have decision making authority of the Contractor. Communications given to the superintendent shall be binding as if given to the Contractor. The superintendent shall not be changed by the contractor without approval from the Owner’s Representative.

3.4.5 The Contractor shall establish and maintain a permanent bench mark to which access may be had during progress of the Work, and Contractor shall establish all lines and levels, and shall be responsible for the correctness of such. Contractor shall be fully responsible for all layout work for the proper location of Work in strict accordance with the Contract Documents.

3.4.6 The Contractor shall establish and be responsible for wall and partition locations. If applicable, separate contractors shall be entitled to rely upon these locations and for setting their sleeves, openings, or chases.

3.4.7 The Contractor’s scheduled outage/tie-in plan, time, and date for any utilities is subject to approval by the Owner’s Representative. Communication with the appropriate entity and planning for any scheduled outage/tie-in of utilities shall be the responsibility of the Contractor. Failure of Contractor to comply with the provisions of this Paragraph shall cause Contractor to forfeit any right to an adjustment of the Contract Sum or Contract Time for any postponement, rescheduling or other delays ordered by Owner in connection with such Work. The Contractor shall follow the following procedures for all utility outages/tie-ins or disruption of any building system:

.1 All shutting of valves, switches, etc., shall be by the Owner's personnel.
3.4.12 The Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences, and other devices appropriately located on site which shall give proper and understandable warning to all persons of danger of entry onto land, structure, or equipment, within the limits of the Contractor’s work area.

3.4.13 The Contractor shall pump, bail, or otherwise keep any general excavations free of water. The Contractor shall keep all areas free of water before, during and after concrete placement. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials installed, or to be installed by him.

3.4.14 The Contractor shall be responsible for care of the Work and must protect same from damage of defacement until acceptance by the Owner. All damaged or defaced Work shall be repaired or replaced to the Owner's satisfaction, without cost to the Owner.

3.4.15 When requested by the Owner's Representative, the Contractor, at no extra charge, shall provide scaffolds or ladders in place as may be required by the Architect or the Owner for examination of Work in progress or completed.

3.4.16 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor’s employees, Subcontractors of any tier and their agents and employees, and any entity or other persons performing portions of the Work.

3.4.17 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Owner’s Representative or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.4.18 The Contractor shall be responsible for inspection of portions of the Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

3.5 Use of Site

3.5.1 The Contractor shall limit operations and storage of material to the area within the Work limit lines shown on Drawings, except as necessary to connect to exiting utilities, shall not encroach on neighboring property, and shall exercise caution to prevent damage to existing structures.

3.5.2 Only materials and equipment, which are to be used directly in the Work, shall be brought to and stored on the Work site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Work site. Protection of construction materials and equipment stored at the Work site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.
3.5.3 No project signs shall be erected without the written approval of the Owner's Representative.

3.5.4 The Contractor shall ensure that the Work is at all times performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. Particular attention shall be paid to access for emergency vehicles, including fire trucks. Wherever there is the possibility of interfering with normal emergency vehicle operations, Contractor shall obtain permission from both campus and municipal emergency response entities prior to limiting any access. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall not interfere with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work or (2) the Work in the event of partial occupancy. Contractor shall assume full responsibility for any damage to the property comprising the Work or to the owner or occupant of any adjacent land or areas resulting from the performance of the Work.

3.5.5 The Contractor shall not permit any workers to use any existing facilities at the Work site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by Owner. The Contractor, Subcontractors of any tier, suppliers and employees shall comply with instructions or regulations of the Owner’s Representative governing access to, operation of, and conduct while in or on the premises and shall perform all Work required under the Contract Documents in such a manner as not to unreasonably interrupt or interfere with the conduct of Owner’s operations. Any request for Work, a suspension of Work or any other request or directive received by the Contractor from occupants of existing buildings shall be referred to the Owner’s Representative for determination.

3.5.6 The Contractor and the Subcontractor of any tier shall have its’ name, acceptable abbreviation or recognizable logo and the name of the city and state of the mailing address of the principal office of the company, on each motor vehicle and motorized self-propelled piece of equipment which is used in connection with the project. The signs are required on such vehicles during the time the Contractor is working on the project.

3.6 Review of Contract Documents and Field Conditions by Contractor

3.6.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Architect and Owner and shall at once report in writing to the Architect and Owner's Representative any errors, inconsistencies or omissions discovered. If the Contractor performs any construction activity which it knows or should have known involves a recognized error, inconsistency or omission in the Contract Documents without such written notice to the Architect and Owner’s Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

3.6.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported in writing to the Architect and Owner’s Representative within twenty-four (24) hours. During the progress of work, Contractor shall verify all field measurements prior to fabrication of building components or equipment, and proceed with the fabrication to meet field conditions. Contractor shall consult all Contract Documents to determine the exact location of all work and verify spatial relationships of all work. Any question concerning said location or spatial relationships shall be submitted to the Owner's Representative. Specific locations for equipment, pipelines, ductwork and other such items of work, where not dimensioned on plans, shall be determined in consultation with Owner's Representative and Architect. Contractor shall be responsible for the proper fitting of the Work in place.

3.6.3 The Contractor shall provide, at the proper time, such material as required for support of the Work. If openings or chases are required, whether shown on Drawings or not, the Contractor shall see they are properly constructed. If required openings or chases are omitted, the Contractor shall cut them at the Contractors own expense, but only as directed by the Architect, through the Owner Representative.

3.6.4 Should the Contract Documents fail to particularly describe materials or goods to be used, it shall be the duty of the Contractor to inquire of the Architect and the Owner’s Representative what is to be used and to supply it at the Contractor’s expense, or else thereafter replace it to the Owner’s Representative’s satisfaction. At a minimum, the Contractor shall provide the quality of materials as generally specified throughout the Contract Documents.

3.7 Cleaning and Removal

3.7.1 The Contractor shall keep the Work site and surrounding areas free from accumulation of waste materials, rubbish, debris, and dirt resulting from the Work and shall
clean the Work site and surrounding areas as requested by the Architect and the Owner's Representative, including mowing of grass greater than 6 inches high. The Contractor shall be responsible for the cost of clean up and removal of debris from premises. The building and premises shall be kept clean, safe, in a workmanlike manner, and in compliance with OSHA standards at all times. At completion of the Work, the Contractor shall remove from and about the Work site tools, construction equipment, machinery, fencing, and surplus materials. Further, at the completion of the work, all dirt, stains, and smudges shall be removed from every part of the building, all glass in doors and windows shall be washed, and entire Work shall be left broom clean in a finished state ready for occupancy. The Contractor shall advise his Subcontractors of any tier of this provision, and the Contractor shall be fully responsible for leaving the premises in a finished state ready for use to the satisfaction of the Owner's Representative. If the Contractor fails to comply with the provisions of this paragraph, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.8 Cutting and Patching
3.8.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

3.8.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.8.3 If the Work involves renovation and/or alteration of existing improvements, Contractor acknowledges that cutting and patching of the Work is essential for the Work to be successfully completed. Contractor shall perform any cutting, altering, patching, and/or fitting of the Work necessary for the Work and the existing improvements to be fully integrated and to present the visual appearance of an entire, completed, and unified project. In performing any Work which requires cutting or patching, Contractor shall use its best efforts to protect and preserve the visual appearance and aesthetics of the Work to the reasonable satisfaction of both the Owner's Representative and Architect.

3.9 Indemnification

3.9.1 To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Owner, the Architect, Architect’s consultants, and the agents, employees, representatives, insurers and re-insurers of any of the foregoing (hereafter collectively referred to as the “Indemnitees”) from and against claims, damages (including loss of use of the Work itself), punitive damages, penalties and civil fines unless expressly prohibited by law, losses and expenses, including, but not limited to, attorneys’ fees, arising out of or resulting from performance of the Work to the extent caused in whole or in part by negligent acts or omissions or other fault of Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by the negligent acts or omissions or other fault of a party indemnified hereunder. The Contractor’s obligations hereunder are in addition to and shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that the Owner may possess. If one or more of the Indemnitees demand performance by the Contractor of obligations under this paragraph or other provisions of the Contract Documents and if Contractor refuses to assume or perform, or delays in assuming or performing Contractor’s obligations, Contractor shall pay each Indemnitee who has made such demand its respective attorneys’ fees, costs, and other expenses incurred in enforcing this provision. The defense and indemnity required herein shall be a binding obligation upon Contractor whether or not an Indemnitee has made such demand. Even if a defense is successful to a claim or demand for which Contractor is obligated to indemnify the Indemnitees from under this Paragraph, Contractor shall remain liable for all costs of defense.

3.9.2 The indemnity obligations of Contractor under this Section 3.9 shall survive termination of this Contract or final payment thereunder. In the event of any claim or demand made against any party which is entitled to be indemnified hereunder, the Owner may in its sole discretion reserve, return or apply any monies due or to become due the Contractor under the Contract for the purpose of resolving such claims; provided, however, that the Owner may release such funds if the Contractor provides the Owner with reasonable assurance of protection of the Owner’s interests. The Owner shall in its sole discretion determine if such assurances are reasonable. Owner reserves the right to control the defense and settlement of any claim, action or proceeding which Contractor has an obligation to indemnify the Indemnitees against under Paragraph 3.9.1.

3.9.3 In claims against any person or entity indemnified under this Section 3.9 by an employee of the Contractor, a Subcontractor of any tier, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Section 3.9 shall not be limited by a limitation on amount or type of
damages, compensation or benefits payable by or for the Contractor or a Subcontractor of any tier under workers’ or workmen’s compensation acts, disability benefit acts or other employee benefit acts.

3.9.4 The obligations of the Contractor under Paragraph 3.9.1 shall not extend to the liability of the Architect, his agents or employees, arising out of the preparation and approval of maps, drawings, opinions, reports, surveys, Change Orders, designs, or Specifications.

3.10 Patents
3.10.1 The Contractor shall hold and save harmless the Owner and its officers, agents, servants, and employees from liability of any nature or kind, including cost and expense, for, or on account of, any patented or otherwise protected invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

3.10.2 If the Contractor uses any design, device, or material covered by letters patent or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device, or material. It is mutually agreed and understood, without exception, that the Contract Sum includes and the Contractor shall pay all royalties, license fees or costs arising from the use of such design, device, or material in any way involved in the Work. The Contractor and/or sureties shall indemnify and save harmless the Owner from and all claims for infringement by reason of the use of such patented or copyrighted design, device, or material or any trademark or copyright in connection with Work agreed to be performed under this Contract and shall indemnify the Owner for any cost, expense, or damage it may be obligated to pay by reason of such infringement at any time during the prosecution of the Work or after completion of the Work.

3.11 Materials, Labor, and Workmanship
3.11.1 Materials and equipment incorporated into the Work shall strictly conform to the Contract Documents and representations and approved Samples provided by Contractor and shall be of the most suitable grade of their respective kinds for their respective uses, and shall be fit and sufficient for the purpose intended, merchantable, of good new material and workmanship, and free from defect. Workmanship shall be in accordance with the highest standard in the industry and free from defect in strict accordance with the Contract Documents.

3.11.2 Materials and fixtures shall be new and of latest design unless otherwise specified, and shall provide the most efficient operating and maintenance costs to the Owner. All Work shall be performed by competent workers and shall be of best quality.

3.11.3 The Contractor shall carefully examine the Contract Documents and shall be responsible for the proper fitting of his material, equipment, and apparatus into the building.

3.11.4 The Contractor shall base his bid only on the Contract Documents.

3.11.5 Materials and workmanship shall be subject to inspection, examination, and test by the Architect and the Owner's Representative at any and all times during manufacture, installation, and construction of any of them, at places where such manufacture, installation, or construction is performed.

3.11.6 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.11.7 Unless otherwise specifically noted, the Contractor shall provide and pay for supervision, labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

3.11.8 Substitutions
3.11.8.1 A substitution is a Contractor proposal of an alternate product or method in lieu of has been specified or shown in the Contract Documents, which is not an “or equal” as set forth in Section 3.12.1.

3.11.8.2 Contractor may make a proposal to the Architect and the Owner’s Representative to use substitute products or methods as set forth herein, but the Architect's and the Owner’s Representative’s decision concerning acceptance of a substitute shall be final. The Contractor must do so in writing and setting forth the following:

.1 Full explanation of the proposed substitution and submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation of the substitution.

.2 Reasons the substitution is advantageous and necessary, including the benefits to the Owner and the Work in the event the substitution is acceptable.

.3 The adjustment, if any, in the Contract Sum, in the event the substitution is acceptable.

.4 The adjustment, if any, in the time of completion of the Contract and the construction schedule in the event the substitution is acceptable.

.5 An affidavit stating that (a) the proposed substitution conforms to and meets all of the
Contract Documents, except as specifically disclosed and set forth in the affidavit and (b) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect. Proposals for substitutions shall be submitted to the Architect and Owner’s Representative in sufficient time to allow the Architect and Owner’s Representative no less than ten (10) working days for review. No substitution will be considered or allowed without the Contractor’s submittal of complete substantiating data and information as stated herein.

3.11.8.3 Substitutions may be rejected without explanation in Owner’s sole discretion and will be considered only under one or more of the following conditions:

1. Required for compliance with interpretation of code requirements or insurance regulations then existing;
2. Unavailability of specified products, through no fault of the Contractor;
3. Material delivered fails to comply with the Contract Documents;
4. Subsequent information discloses inability of specified products to perform properly or to fit in designated space;
5. Manufacturer/fabricator refuses to certify or guarantee performance of specified product as required; or
6. When in the judgment of the Owner or the Architect, a substitution would be substantially to the Owner's best interests, in terms of cost, time, or other considerations.

3.11.8.4 Whether or not any proposed substitution is accepted by the Owner or the Architect, the Contractor shall reimburse the Owner for any fees charged by the Architect or other consultants for evaluating each proposed substitute.

3.12 Approved Equal
3.12.1 Whenever in the Contract Documents any article, appliance, device, or material is designated by the name of a manufacturer, vendor, or by any proprietary or trade name, the words "or approved equal," shall automatically follow and shall be implied unless specifically indicated otherwise. The standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner’s Representative and the Architect they are equal in design, appearance, spare parts availability, strength, durability, usefulness, serviceability, operation cost, maintenance cost, and convenience for the purpose intended. Any general listings of approved manufacturers in any Contract Document shall be for informational purposes only and it shall be the Contractor’s sole responsibility to ensure that any proposed “or equal” complies with the requirements of the Contract Documents.

3.12.2 The Contractor shall submit to Architect and Owner’s Representative a written and full description of the proposed “or equal” including all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and similar information demonstrating that the proposed “or equal” strictly complies with the Contract Documents. The Architect or Owner’s Representative shall take appropriate action with respect to the submission of a proposed “or equal” item. If Contractor fails to submit proposed “or equals” as set forth herein, it shall waive any right to supply such items. The Contract Sum and Contract Time shall not be adjusted as a result of any failure by Contractor to submit proposed “or equals” as provided for herein. All documents submitted in connection with preparing an “or equal” shall be clearly and obviously marked as a proposed “or equal” submission.

3.12.3 No approvals or action taken by the Architect or Owner’s Representative shall relieve Contractor from its obligation to ensure that an “or equal” article, appliance, devise or material strictly complies with the requirements of the Contract Documents. Contractor shall not propose “or equal” items in connection with Shop Drawings or other Submittals, and Contractor acknowledges and agrees that no approvals or action taken by the Architect or Owner’s Representative with respect to Shop Drawings or other Submittals shall constitute approval of any “or equal” item or relieve Contractor from its sole and exclusive responsibility. Any changes required in the details and dimensions indicated in the Contract Documents for the incorporation or installation of any “or equal” item supplied by the Contractor shall be properly made and approved by the Architect at the expense of the Contractor. No ‘or equal’ items will be permitted for components of or extensions to existing systems when, in the opinion of the Architect, the named manufacturer must be provided in order to ensure compatibility with the existing systems, including, but not limited to, mechanical systems, electrical systems, fire alarms, smoke detectors, etc. No action will be taken by the Architect with respect to proposed “or equal” items prior to receipt of bids, unless otherwise noted in the Special Conditions.

3.13 Shop Drawings, Product Data, Samples, and Coordination Drawings/BIM Models
3.13.1 Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
3.13.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.13.3 Samples are physical samples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.13.4 Coordination Drawings are drawings for the integration of the Work, including work first shown in detail on shop drawings or product data. Coordination drawings show sequencing and relationship of separate units of work which must interface in a restricted manner to fit in the space provided, or function as indicated. Coordination Drawings are the responsibility of the contractor and are submitted for informational purposes. The Special Conditions will state whether coordination drawings are required. BIM models may be used for coordination in lieu of coordination drawings at the contractor’s discretion, unless required in the Special Conditions. The final coordination drawings/BIM Model will not change the contract documents, unless approved by a fully executed change order describing the specific modifications that are being made to the contract documents.

3.13.5 Shop Drawings, Coordination Drawings/BIM Models, Product Data, Samples and similar submittals (collectively referred to as “Submittals”) are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

3.13.6 The Contractor shall schedule submittal of Shop Drawings and Product Data to the Architect so that no delays will result in delivery of materials and equipment, advising the Architect of priority for checking of Shop Drawings and Product Data, but a minimum of two weeks shall be provided for this purpose. Because time is of the essence in this contract, unless noted otherwise in the Special Conditions or Technical Specifications, all submittals, shop drawings and samples must be submitted as required to maintain the contractor’s plan for proceeding, but must be submitted within 90 days of the Notice To Proceed. If Contractor believes that this milestone is unreasonable for any submittal, Contractor shall request an extension of this milestone, within 60 days of Notice To Proceed, for each submittal that cannot meet the milestone. The request shall contain a reasonable explanation as to why the 90 day milestone is unreasonable, and shall specify a date on which the submittal will be transmitted, for approval by the Owner’s Representative. Failure of the Contractor to comply with this section may result in delays in the submittal approval process and/or charges for expediting approval, both of which will be the responsibility of the Contractor.

3.13.7 The Contractor, at its own expense, shall submit Samples required by the Contract Documents with reasonable promptness as to cause no delay in the Work or the activities of separate contractors and no later than twenty (20) days before materials are required to be ordered for scheduled delivery to the Work site. Samples shall be labeled to designate material or products represented, grade, place of origin, name of producer, name of Contractor and the name and number of the Owner’s project. Quantities of Samples shall be twice the number required for testing so that Architect can return one set of the Samples. Materials delivered before receipt of Architect’s approval may be rejected by Architect and in such event, Contractor shall immediately remove all such materials from the Work site. When requested by Architect or Owner’s Representative, samples of finished masonry and field applied paints and finishes shall be located as directed and shall include sample panels built at the site of approximately twenty (20) square feet each.

3.13.8 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.

3.13.9 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents such Submittals strictly comply with the requirements of the Contract Documents and that the Contractor has determined and verified field measurements and field construction criteria related thereto, that materials are fit for their intended use and that the fabrication, shipping, handling, storage, assembly and installation of all materials, systems and equipment are in accordance with best practices in the industry and are in strict compliance with any applicable requirements of the Contract Documents. Contractor shall also coordinate each Submittal with other Submittals.

3.13.10 Contractor shall be responsible for the correctness and accuracy of the dimensions, measurements and other information contained in the Submittals.

3.13.11 Each Submittal will bear a stamp or specific indication that the Submittal complies with the Contract Documents and Contractor has satisfied its obligations under the Contract Documents with respect to Contractor’s review and approval of that Submittal. Each Submittal shall bear the signature of the representative of Contractor who approved the Submittal, together with the Contractor’s name, Owner’s name, number of the Project, and the item name and specification section number.

3.13.12 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data,
Samples or similar submittals. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof. Specifically, but not by way of limitation, Contractor acknowledges that Architect's approval of Shop Drawings shall not relieve Contractor for responsibility for errors and omissions in the Shop Drawings since Contractor is responsible for the correctness of dimensions, details and the design of adequate connections and details contained in the Shop Drawings.

3.13.13 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous Submittals.

3.13.14 The Contractor represents and warrants that all Shop Drawings shall be prepared by persons and entities possessing expertise and experience in the trade for which the Shop Drawing is prepared and, if required by the Architect or applicable Laws, by a licensed engineer or other design professional.

3.14 Record Drawings

3.14.1 The Contractor shall maintain a set of Record Drawings on site in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (1) bidding addendums, (2) executed change orders, (3) deviations from the Drawings made during construction; (4) details in the Work not previously shown; (5) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (6) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs; and (7) such other information as either Owner or Architect may reasonably request. The prints for Record Drawing use will be a set of “blue line” prints provided by Architect to Contractor at the start of construction. Upon Substantial Completion of the Work, Contractor shall deliver all Record Drawings to Owner and Architect for approval. If not approved, Contractor shall make the revisions requested by Architect or Owner’s Representative. Final payment and any retainage shall not be due and owing to Contractor until the final Record Drawings marked by Contractor as required above are delivered to Owner.

3.15 Operating Instructions and Service Manuals

3.15.1 The Contractor shall submit four (4) volumes of operating instructions and service manuals to the Architect before completing 50% of the adjusted contract amount. Payments beyond 50% of the adjusted contract amount may be withheld until all operating instructions and service manuals are received. The operating instructions and service manuals shall contain:

.1 Start-up and Shutdown Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available, they may be incorporated into the operating manual for reference.

.2 Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.

.3 Equipment List: List of all major equipment as installed shall include model number, capacities, flow rate, and name-plate data.

.4 Service Instructions: The Contractor shall be required to provide the following information for all pieces of equipment.

(a) Recommended spare parts including catalog number and name of local suppliers or factory representative.

(b) Belt sizes, types, and lengths.

(c) Wiring diagrams.

.5 Manufacturer’s Certificate of Warranty: Manufacturer’s certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year from the date of Substantial Completion. Where longer period is required by the Contract Documents, the longer period shall govern.

.6 Parts catalogs: For each piece of equipment furnished, a parts catalog or similar document shall be provided which identifies the components by number for replacement ordering.

3.15.2 Submission

.1 Manuals shall be bound into volumes of standard 8 1/2" x 11" hard binders. Large drawings too bulky to be folded into 8 1/2" x 11" shall be separately bound or folded and in brown envelopes, cross-referenced and indexed with the manuals.

.2 The manuals shall identify the Owner’s project name, project number, and include the name and address of the Contractor and major Subcontractors of any tier who were involved with the activity described in that particular manual.

3.16 Taxes

3.16.1 The Contractor shall pay all applicable sales, consumer, use, and similar taxes for the Work which are legally enacted when the bids are received, whether or not yet effective or scheduled to go into effect. However, certain purchases by the Contractor of materials incorporated in or consumed in the Work are exempt from certain sales tax pursuant to RSMo § 144.062. The Contractor shall be issued a Project Tax Exemption Certificate for this Work to obtain the benefits of RSMo § 144.062.

3.16.2 The Contractor shall furnish this certificate to all subcontractors, and any person or entity purchasing materials
for the Work shall present such certificate to all material suppliers as authorization to purchase, on behalf of the Owner, all tangible personal property and materials to be incorporated into or consumed in the Work and no other on a tax-exempt basis. Such suppliers shall provide to the purchasing party invoices bearing the name of the exempt entity and the project identification number. Nothing in this section shall be deemed to exempt from any sales or similar tax the purchase of any construction machinery, equipment or tools used in construction, repairing or remodeling facilities for the Owner. All invoices for all personal property and materials purchased under a Project Tax Exemption Certificate shall be retained by the Contractor for a period of five years and shall be subject to audit by the Director of Revenue.

3.17.1 The Contractor, within fifteen (15) days after the issuance of the Notice to Proceed, shall prepare and submit for the Owner's and Architect's information Contractor's construction schedule for the Work and shall set forth interim dates for completion of various components of the Work and Work Milestone Dates as defined herein. The schedule shall not exceed time limits current under the Contract Documents, shall be revised on a monthly basis or as requested by the Owner's Representative as required by the conditions of the Work, and shall provide for expeditious and practicable execution of the Work. The Contractor shall conform to the most recent schedule.

3.17.2 The construction schedule shall be in a detailed format satisfactory to the Owner’s Representative and the Architect and in accordance with the detailed schedule requirements set forth in this document and the Special Conditions. If the Owner’s Representative or Architect has a reasonable objection to the schedule submitted by Contractor, the construction schedule shall be promptly revised by the Contractor. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays.

3.17.3 As time is of the essence to this contract, the University expects that the Contractor will take all necessary steps to insure that the project construction schedule shall be prepared in accordance with the specific requirements of the Special Conditions to this contract. At a minimum, contractor shall comply with the following:

.1 The schedule shall be prepared using Primavera P3, Oracle P6, Microsoft Project or other software acceptable to the Owner’s Representative.

.2 The schedule shall be prepared and maintained in CPM format, in accordance with Construction CPM Scheduling, published by the Associated General Contractors of American (AGC).

.3 Prior to submittal to the Owner’s Representative for review, Contractor shall obtain full buy-in to the schedule from all major subcontractors, in writing if so requested by Owner’s Representative.

.4 Schedule shall be updated, in accordance with Construction CPM Scheduling, published by the AGC, on a monthly basis at minimum, prior to, and submitted with, the monthly pay application or as requested by the Owner’s Representative.

.5 Along with the update the Contractor shall submit a narrative report addressing all changes, delays and impacts, including weather to the schedule during the last month, and explain how the end date has been impacted by same.

.6 The submission of the updated certifies that all delays and impacts that have occurred on or to the project during the previous month have been factored into the update and are fully integrated into the schedule and the projected completion date.

Failure to comply with any of these requirements will be considered a material breach of this contract. See Special Conditions for detailed scheduling requirements.

3.17.4 In the event the Owner’s Representative or Architect determines that the performance of the Work, as of a Milestone Date, has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the
The Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule. The Contractor shall not be entitled to an adjustment in the Contract Sum concerning Extraordinary Measures required by the Owner under or pursuant to this Paragraph 3.17.3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph 3.17.3 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.

ARTICLE 4
ADMINISTRATION OF THE CONTRACT

4.1 Rights of the Owner
4.1.1 The Owner's Representative will administer the Construction Contract. The Architect will assist the Owner's Representative with the administration of the Contract as indicated in these Contract Documents.

4.1.2 If, in the judgment of the Owner's Representative, it becomes necessary to accelerate the work, the Contractor, when directed by the Owner's Representative in writing, shall cease work at any point and transfer its workers to such point or points and execute such portions of the work as may be required to enable others to hasten and properly engage and carry out the work, all as directed by the Owner's Representative. The additional cost of accelerating the work, if any, will be borne by the Owner, unless the Contractor's work progress is behind schedule as shown on the most recent progress schedule.

4.1.3 If the Contractor refuses, for any reason, to proceed with what the Owner believes to be contract work, the Owner may issue a Construction Directive, directing the Contractor to proceed. Contractor shall be obligated to promptly proceed with this work. If Contractor feels that it is entitled to additional compensation for this work, it may file a claim for additional compensation and/or time, in accordance with 4.4 of this document.

4.1.4 The Owner's Representative, may, by written notice, require a Contractor to remove from involvement with the Work, any of Contractor's personnel or the personnel of its Subcontractors of any tier whom the Owner's Representative may deem abusive, incompetent, careless, or a hindrance to proper and timely execution of the Work. The Contractor shall comply with such notice promptly, but without detriment to the Work or its progress.

4.1.5 The Owner's Representative will schedule Work status meetings that shall be attended by representatives of the Contractor and appropriate Subcontractors of any tier. Material suppliers shall attend status meetings if required by the Owner's Representative. These meetings shall include preconstruction meetings.

4.1.6 The Owner does not allow smoking on University property.

4.2 Rights of the Architect
4.2.1 The Architect will interpret requirements of the Contract Documents with respect to the quality, quantity and other technical requirements of the Work itself within a reasonable time after written request of the Contractor. Contractor shall provide Owner’s Representative a copy of such written request.

4.3 Review of the Work
4.3.1 The Architect and the Owner's Representative shall, at all times, have access to the Work; and the Contractor shall provide proper and safe facilities for such access.

4.3.2 The Owner’s Representative shall have authority to reject Work that does not strictly comply with the requirements of the Contract Documents. Whenever the Owner’s Representative considers it necessary or advisable for implementation of the intent of the Contract Documents, Owner’s Representative shall have the authority to require additional inspection or testing of the Work, whether or not such Work is fabricated, installed or completed.

4.3.3 The fact that the Architect or the Owner's Representative observed, or failed to observe, faulty Work, or Work done which is not in accordance with the Contract Documents, regardless of whether or not the Owner has released final payment, shall not relieve the Contractor from responsibility for all damages and additional costs of the Owner as a result of defective or faulty Work.

4.4 Claims
4.4.1 A Claim is a demand or assertion by Contractor seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or any other relief with respect to the terms of the Contract. The term "Claim(s)" also includes demands and assertions of Contractor arising out of or relating to the Contract Documents, including Claims based upon breach of contract, mistake, misrepresentation, or other cause for Contract Modification or
Claims must be made by written notice. Contractor shall have the responsibility to substantiate Claims.

4.4.2 Claims by Contractor must be made promptly, and no later than within fourteen (14) days after occurrence of the event giving rise to such Claim. Claims must be made by written notice. Such notice shall include a detailed statement setting forth all reasons for the Claim and the amount of additional money and additional time claimed by Contractor. The notice of Claims shall also strictly comply with all other provisions of the Contract Documents. Contractor shall not be entitled to rely upon any grounds or basis for additional money on additional time not specifically set forth in the notice of Claim. All Claims not made in the manner provided herein shall be deemed waived and of no effect. Contractor shall furnish the Owner and Architect such timely written notice of any Claim provided for herein, including, without limitation, those in connection with alleged concealed or unknown conditions, and shall cooperate with the Owner and Architect in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim.

4.4.3 Pending final resolution of a Claim, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments that are not in dispute in accordance with the Contract Documents.

4.5 Claims for Concealed or Unknown Conditions

4.5.1 If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Owner's Representative promptly before conditions are disturbed, and in no event later than three (3) days after first observance of the conditions. The Owner's Representative will promptly investigate such conditions. If such conditions differ materially, as provided for above and cause an increase or decrease in the Contractor’s cost, or time, required for performance of the Work, an equitable adjustment in the Contract sum or Contract Time, or both, shall be made, subject to the provisions and restrictions set for herein. If the Owner's Representative determines that the conditions at the site are not materially different from those indicated in the Contract Documents, and that no change in the terms of the Contract is justified, the Owner's Representative will so notify the Contractor in writing. If the Contractor disputes the finding of the Owner’s Representative that no change in the terms of the Contract terms is justified, Contractor shall proceed with the Work, taking whatever steps are necessary to overcome or correct such conditions so that Contractor can proceed in a timely manner. The Contractor may have the right to file a Claim in accordance with the Contract Documents.

4.5.2 It is expressly agreed that no adjustment in the Contract Time or Contract Sum shall be permitted, however, in connection with a concealed or unknown condition which does not differ materially from those conditions disclosed or which reasonably should have been disclosed by the Contractor’s (1) prior inspections, tests, reviews and preconstruction investigations for the Project, or (2) inspections, tests, reviews and preconstruction inspections which the Contractor had the opportunity to make or should have performed in connection with the Project.

4.6 Claim for Additional Cost

4.6.1 If the Contractor makes a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. In addition to all other requirements for notice of a Claim, said notice shall detail and itemize the amount of all Claims and shall contain sufficient data to permit evaluation of same by Owner.

4.7 Claims for Additional Time

4.7.1 If the Contractor makes a Claim for an increase in the Contract Time, written notice as provided herein shall be given. In addition to other requirements for notice of a Claim, Contractor shall include an estimate of the probable effect of delay upon the progress of the Work, utilizing a CPM Time Impact Schedule Analysis, (TIA) as defined in the AGC Scheduling Manual. In the case of a continuing delay, only one Claim is necessary.

4.7.2 If weather days are the basis for a Claim for additional time, such Claim shall be documented by the Contractor by data acceptable to the Owner's Representative substantiating that weather conditions for the period of time in question, had an adverse effect on the critical path of the scheduled construction. Weather days shall be defined as days on which critical path work cannot proceed due to weather conditions (including but not limited to rain, snow, etc.), in excess of the number of days shown on the Anticipated Weather Day schedule in the Special Conditions. To be considered a weather day, at least four hours must be lost due to the weather conditions on a critical path scope item for that day. Weather days and Anticipated weather days listed in the Special Conditions shall only apply to Monday through Friday. A weather day claim cannot be made for Saturdays, Sundays, New Year’s Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving Day and

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Christmas Day, unless that specific day was approved in writing for work by the Owner’s Representative.

4.7.4 The Owner will consider and evaluate requests for time extensions due to changes or other events beyond the control of the Contractor on a monthly basis only, with the submission of the Contractor’s updated schedule, in conjunction with the monthly application for payment.

4.8 Resolution of Claims and Disputes
4.8.1 The Owner's Representative will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the Contractor, (2) reject the Claim in whole or in part, (3) approve the Claim, or (4) suggest a compromise.

4.8.2 If a Claim has not been resolved, the Contractor shall, within ten days after the Owner's Representative's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested, (2) modify the initial Claim, or (3) notify the Owner's Representative that the initial Claim stands.

4.8.3 If a Claim has not been resolved after consideration of the foregoing and of further information presented by the Contractor, the Contractor has the right to seek administrative review as set forth in Section 4.9. However, Owner’s Representative’s decisions on matters relating to aesthetics will be final.

4.9 Administrative Review
4.9.1 Claims not resolved pursuant to the procedures set forth in the Contract Documents except with respect to Owner’s Representative’s decision on matters relating to aesthetic effect, and except for claims which have been waived by the making or acceptance of final payment, or the Contractor's acceptance of payments in full for changes in work may be submitted to administrative review as provided in this section. All requests for administrative review shall be made in writing.

4.9.2 Upon written request from the Contractor, the Owner’s Review Administrator authorized by the Campus Contracting Officer will convene a review meeting between the Contractor and Owner’s Representative’s within fifteen (15) days of receipt of such written request. The Contractor and Owner’s Representative will be allowed to present written documentation with respect to the claim(s) before or during the meeting. The Contractor and Owner’s Representative will be allowed to present the testimony of any knowledgeable person regarding the claim at the review meeting. The Owner’s Review Administrator will issue a written summary of the review meeting and decision to resolve the Claim within fifteen (15) days. If the Contractor is in agreement with the decision the Contractor shall notify the Owner’s Review Administrator in writing within five (5) days, and appropriate documentation will be signed by the parties to resolve the Claim.

4.9.3 If the Contractor is not in agreement with the proposal of the Owner’s Review Administrator as to the resolution of the claim, the Contractor may file a written appeal with the UM System Contracting Officer, [in care of the Director of Facilities Planning and Development, GC/17
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University of Missouri, 109 Old Alumni Centers, University of Missouri, Columbia, Missouri 65211] within fifteen (15) days after receipt of the Owner’s Review Administrator’s proposal. The UM System Contracting Officer will call a meeting of the Contractor, the Owner’s Representative, and the Owner’s Review Administrator by written notice, within thirty (30) days after receipt of the Contractor's written appeal. The Owner’s Review Administrator shall provide the UM System Contracting Officer with a copy of the written decision and summary of the review meeting, the Contractor's corrections or comments regarding the summary of the review meeting, and any written documentation presented by the Contractor and the Owner’s Representative at the initial review meeting. The parties may present further documentation and/or present the testimony of any knowledgeable person regarding the claim at the meeting called by the UM System Contracting Officer.

4.9.4 The UM System Contracting Officer will issue a written decision to resolve the claim within fifteen (15) days after the meeting. If the Contractor is in agreement with the UM System Contracting Officer's proposal, the Contractor shall notify the UM System Contracting Officer in writing within five (5) days, and the Contractor and the Owner shall sign appropriate documents. The issuance of the UM System Contracting Officer's written proposal shall conclude the administrative review process even if the Contractor is not in agreement. However, proposals and any opinions expressed in such proposals issued under this section will not be binding on the Contractor nor will the decisions or any opinions expressed be admissible in any legal actions arising from the Claim and will not be deemed to remove any right or remedy of the Contractor as may otherwise exist by virtue of Contract Documents or law. Contractor and Owner agree that the Missouri Circuit Court for the County where the Work is located shall have exclusive jurisdiction to determine all issues between them. Contractor agrees not to file any complaint, petition, lawsuit or legal proceeding against Owner except with such Missouri Circuit Court.

ARTICLE 5
SUBCONTRACTORS

5.1 Award of Subcontracts
5.1.1 Pursuant to Article 9, the Contractor shall furnish the Owner and the Architect, in writing, with the name, and trade for each Subcontractor and the names of all persons or entities proposed as manufacturers of products, materials and equipment identified in the Contract Documents and where applicable, the name of the installing contractor. The Owner’s Representative will reply to the Contractor in writing if the Owner has reasonable objection to any such proposed person or entity. The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection.

5.1.2 The Contractor may request to change a subcontractor. Any such request shall be made in writing to the Owner’s Representative. The Contractor shall not change a Subcontractor, person, or entity previously disclosed if the Owner makes reasonable objection to such change.

5.1.3 The Contractor shall be responsible to the Owner for acts, defaults, and omissions of its Subcontractors of any tier.

5.2 Subcontractual Relations
5.2.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor of any tier, to the extent of the Work to be performed by the Subcontractor of any tier, to be bound to the Contractor by terms of the Contract Documents and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and the Architect. Each subcontract agreement of any tier shall preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor of any tier so that subcontracting thereof will not prejudice such rights and shall allow to the Subcontractor of any tier, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with its sub-subcontractors. The Contractor shall make available to each proposed Subcontractor of any tier, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor of any tier shall be bound. Subcontractors of any tier shall similarly make copies of applicable portions of such documents available to their respective proposed Subcontractors of any tier.

5.2.2 All agreements between the Contractor and a Subcontractor or supplier shall contain provisions whereby Subcontractor or supplier waives all rights against the Owner, contractor, Owner’s representative, Architect and all other additional insureds for all losses and damages caused by, arising out of, or resulting from any of the perils covered by property or builders risk insurance coverage required of the Contractor in the Contract Documents. If Contractor fails to include said provisions in all subcontracts, Contractor shall indemnify, defend and hold all the above entities harmless in the event of any legal action by Subcontractor or supplier. If insureds on any such policies require separate
waiver forms to be signed by any Subcontractors of any tier or suppliers, Contractor shall obtain the same.

5.3 Contingent Assignment of Subcontract
5.3.1 No assignment by the Contractor of any amount or any part of the Contract or of the funds to be received thereunder will be recognized unless such assignment has had the written approval of the Owner, and the surety has been given due notice of such assignment and has furnished written consent hereto. In addition to the usual recitals in assignment Contracts, the following language must be set forth: "it is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of the contract and to claims and to liens for services rendered or materials supplied for the performance of the Work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials.

ARTICLE 6
SEPARATE CONTRACTS AND COOPERATION

6.1 The Owner reserves the right to let other contracts in connection with the Work.

6.2 It shall be the duty of each Contractor to whom Work may be awarded, as well as all Subcontractors of any tier employed by them, to communicate immediately with each other in order to schedule Work, locate storage facilities, etc., in a manner that will permit all Contractors to work in harmony in order that Work may be completed in the manner and within the time specified in the Contract Documents.

6.3 No Contractor shall delay another Contractor by neglecting to perform his work at the proper time. Each Contractor shall be required to coordinate his work with other Contractors to afford others reasonable opportunity for execution of their work. Any costs caused by defective or ill-timed work, including actual damages and liquidated damages for delay, if applicable, shall be borne by the Contractor responsible therefor.

6.4 Each Contractor shall be responsible for damage to Owner's or other Contractor's property done by him or persons in his employ, through his or their fault or negligence. If any Contractor shall cause damage to any other Contractor, the Contractor causing such damage shall upon notice of any claim, settle with such Contractor.

6.5 The Contractor shall not claim from the Owner money damages or extra compensation under this Contract when delayed in initiating or completing his performance hereunder, when the delay is caused by labor disputes, acts of God, or the failure of any other Contractor to complete his performance under any Contract with the Owner, where any such cause is beyond the Owner's reasonable control.

6.6 Progress schedule of the Contractor for the Work shall be submitted to other Contractors as necessary to permit coordinating their progress schedules.

6.7 If Contractors or Subcontractors of any tier refuse to cooperate with the instructions and reasonable requests of other contractors performing work for the Owner under separate contract, in the overall coordinating of the Work, the Owner's Representative may take such appropriate action and issue such instructions as in his judgement may be required to avoid unnecessary and unwarranted delay.

ARTICLE 7
CHANGES IN THE WORK

7.1 CHANGE ORDERS
7.1.1 A change order is a written instrument prepared by the Owner and signed by the Owner and Contractor formalizing their agreement on the following:

.1 a change in the Work
.2 the amount of an adjustment, if any, in the Contract amount
.3 an adjustment, if any, in the Contract time

7.1.2 The Owner may at any time, order additions, deletions, or revisions in the Work by a Change Order or a Construction Change Directive. Such Change Order or Construction Change Directive shall not invalidate the Contract and requires no notice to the surety. Upon receipt of any such document, or written authorization from the Owner’s Representative directing the Contractor to proceed pending receipt of the document, Contractor shall promptly proceed with the Work involved in accordance with the terms set forth therein.

7.1.3 Until such time as the change order is formalized and signed by both the Owner and the Contractor it shall be considered a Change Order Request.

7.1.4 The amount of adjustment in the contract price for authorized Change Orders will be agreed upon before such Change Orders becomes effective and will be determined as follows:

.1 By a lump sum proposal from the Contractor and the Subcontractors of any tier, including overhead and profit.
.2 By a time and material basis with or without a specified maximum. The Contractor shall submit to the Owner’s Representative itemized time and material sheets depicting labor, materials, equipment utilized in completing the Work on a daily basis for the Owner's Representative approval. If this pricing option is utilized, the
Contractor may be required to submit weekly reports summarizing costs to date on time and material change orders not yet finalized.

By unit prices contained in the Contractor's original bid and incorporated in the Construction Contract or subsequently agreed upon. Such unit prices contained in the Contractor's original proposal are understood to include the Contractor's overhead and profit. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order, application of such unit prices to quantities of the Work proposed will cause substantial inequity to the Owner or to the Contractor, the applicable unit prices shall be equitably adjusted.

The Contractor shall submit all fully documented change order requests with corresponding back-up documentation within the time requested by the Owner but no later than fourteen (14) working days following 1.) the Owner’s request for change order pricing in the case of a lump sum; or 2.) the completion of unit price or time and material work.

The Contractor shall submit change order requests in sufficient detail to allow evaluation by the Owner. Such requests shall be fully itemized by units of labor, material and equipment and overhead and profit. Such breakdowns shall be itemized as follows:

1. Labor: The Contractor's proposal shall include breakdowns by labor, by trade, indicating number of hours and cost per hour for each Subcontractor as applicable. Such breakdowns shall only include employees in the direct employ of Contractor or Subcontractors in the performance of the Work. Such employees shall only include laborers at the site, mechanics, craftsmen and foremen. Payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor or Subcontractors. Any item or expense outside of these categories is not allowed. The expense of performing Work after regular working hours, on Saturdays, Sundays or legal holidays shall not be included in the above, unless approved in writing and in advance by Owner.

2. Material, supplies, consumables and equipment to be incorporated into the Work at actual invoice cost to the Contractor or Subcontractors; breakdowns showing all material, installed equipment and consumables fully itemized with number of units installed and cost per unit extended. Any singular item or items in aggregate greater than one thousand dollars ($1,000) in cost shall be supported with supplier invoices at the request of the Owner’s Representative. Normal hand tools are not compensable.

3. Equipment: Breakdown for required equipment shall itemize (at a minimum) delivery / pick-up charge, hourly rate and hours used. Operator hours and rate shall not be included in the equipment breakdown. Contractor must use the most cost effective equipment available in the area and should not exceed the rates listed in the Rental Rate Blue Book for Construction Equipment (Blue Book). Contractor shall submit documentation for the Blue Book to support the rate being requested.

7.2 Construction Change Directive

7.2.1 A construction change directive is a written order prepared and signed by the Owner, issued with supporting documents prepared by the Architect (if applicable), directing a change in the Work prior to agreement on adjustment of the Contract amount or Contract time, or both. A Construction Change Directive shall be used in the absence of complete agreement between the Owner and Contractor on the terms of a change order. If the Construction Change Directive allows an adjustment of the contract amount or time, such adjustment amount shall be based on one of the following methods:

1. A lump sum agreement, properly itemized and supported by substantiating documents of sufficient detail to allow evaluation.

2. By unit prices contained in the Contractor's original proposal and incorporated in the Construction Contract or subsequently agreed upon.

3. A method agreed to by both the Owner and the contractor with a mutually agreeable fee for overhead and profit.

4. In the absence of an agreement between the Owner and the Contractor on the method of establishing an adjustment of the contract amount, the Owner, with the assistance of the architect, shall determine the adjustment amount on the basis of expenditures by the Contractor for labor, materials, equipment and other costs consistent with other provisions of the Contract. The contractor shall keep and submit to the Owner an itemized accounting of all cost components, either expended or saved, while performing the Work covered under the Construction Change Directive.

7.2.2 Upon receipt of a Construction Change Directive, Contractor shall promptly proceed with the change in the Work involved and advise Owner of Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum, Contract Time or both.

7.2.3 A Construction Change Directive signed by Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them.
Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3 Overhead and Profit
7.3.1 Overhead and Profit on Change Orders shall be applied as follows:

1. The overhead and profit charged by the Contractor and Subcontractors shall be considered to include, but not limited to, job site office and clerical expense, normal hand tools, incidental job supervision, field supervision, payroll costs and other compensation for project manager, officers, executives, principals, general managers, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, time-keepers, and other personnel employed whether at the site or in principal or a branch office for general superintendent and administration of the Work.

2. The percentages for overhead and profit charged on Change Orders shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved but in no case shall exceed the following:
   - 15% To the Contractor or the Subcontractor of any tier for Work performed with their respective forces or materials purchased
   - 5% To the Contractor on Work performed by other than his forces
   - 5% To first tier Subcontractor on Work performed by his Subcontractor

3. The Contractor will be allowed to add 2% for the cost of bonding and insurance to their cost of work. This 2% shall be allowed on the total cost of the added work, including overhead and profit.

4. Not more than three mark-ups, not to exceed individual maximums shown above, shall be allowed regardless of the number of tier subcontractors. Overhead and profit shall be shown separately for each subcontractor of any tier and the Contractor.

5. On proposals covering both increases and decreases in the amount of the Contract, the application of overhead and profit shall be on the net change in direct cost for the Contractor or Subcontractor of any tier performing the Work.

6. The percentages for overhead and profit credit to the Owner on Change Orders that are strictly decreases in the quantity of work or materials shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved, but shall not be less than the following: Overhead and Profit
   - 5% Credit to the Contractor or Subcontractor of any tier for Work performed with their respective forces or materials purchased
   - 2.5% Credit to the Owner from the Contractor on Work performed by other than his forces
   - 2.5% Credit to the Owner from the first tier Subcontractor on Work performed by his Subcontractor of any tier

7.4 Extended General Conditions
7.4.1 The Contractor acknowledges that the percentage mark-up allowed on change orders for overhead and profit cover the Contractor’s cost of administering and executing the Work, inclusive of change orders that increase the contract time. Contractor further acknowledges that no compensation beyond the specified mark-up percentages for extended overhead shall be due or payable as a result of an increase in the Contract Time.

7.4.2 The Owner may reimburse the Contractor for extended overhead if an extension of the Contract Time is granted by the Owner, in accordance with Article 4.7.1 and the Owner determines that the extension of the Contract Time creates an inequitable condition for the Contractor. If these conditions are determined by the Owner to exist the Contractor may be reimbursed by unit prices contained in the Contractor's original bid and incorporated in the Construction Contract or by unit prices subsequently agreed upon.

7.4.3 If unit prices are subsequently agreed upon, the Contractor’s compensation shall be limited as follows:

1. For the portion of the direct payroll cost of the Contractor’s project manager expended in completing the Work and the direct payroll cost of other onsite administrative staff not included in Article 7.3.1. Direct payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor;

2. Cost of Contractor’s temporary office, including temporary office utilities expense;

3. Cost of temporary utilities required in the performance of the work;

4. Profit not to exceed 5% of the total extended overhead direct costs;

7.4.4 All costs not falling into one of these categories and costs of the Contractors staff not employed onsite are not allowed.

7.5 Emergency Work
7.5.1 If, during the course of the Work, the Owner has need to engage the Contractor in emergency work, whether related to the Work or not, the Contractor shall immediately
ARTICLE 8
TIME

8.1 Progress and Completion
8.1.1 Contractor acknowledges and agrees that time is of the essence of this Contract

8.1.2 Contract Time is the period of time set forth in the Contract for Construction required for Substantial Completion and Final Completion of the entire Work or portions of the Work as defined in the Contract Documents. Time limits stated in the Contract Documents are of the essence of the Contract. The Contract Time may only be changed by a Change Order. By executing the Contract, the Contractor confirms that the Contract Time is a sufficient period for performing the Work in its entirety.

8.1.3 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance and bonds required by Article 11 to be furnished by the Contractor.

8.1.4 The Contractor shall proceed expeditiously and diligently with adequate forces and shall achieve Substantial Completion and Final Completion within the time specified in the Contract Documents.

8.2 Delay in Completion
8.2.1 The Contractor shall be liable for all of the Owner’s damages for delay in achieving Substantial Completion and/or Final Completion of the entire Work or portions of Work as set forth in the Contract Documents within the Contract Time unless liquidated damages are specifically provided for in the Contract Documents. If liquidated damages are specifically provided for in the Contract for Construction, Contractor shall be liable for such liquidated damages as set forth in Paragraph 8.3.

8.2.2 All time limits stated in the Contract are of the essence of the Contract. However, if the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or by the Owner's Representative, by changes ordered in the Work, by strikes, lockouts, abnormal weather conditions, jurisdictional disputes, or any other causes beyond the Contractor's reasonable control which the Owner's Representative determines may justify delay then, upon submission of the Time Impact Schedule Analysis (TIA) called out in Section 4.7 of these General Conditions, the Contract Time may be extended for a reasonable time to the extent such delay will prevent Contractor from achieving Substantial Completion and/or Final Completion within the Contract Time and if performance of the Work is not, was not or would not have been delayed by any other cause for which the Contractor is not entitled to an extension in the Contract Time under the Contract Documents. It shall be a condition precedent to any adjustment of the Contract Time that Contractor provide the Owner's Representative with written notice of the cause of delay within seven (7) days from the occurrence of the event or condition which caused the claimed delay. Written notices hereunder shall be in accordance with the applicable provisions of Section 4.7.

8.2.3 The Contractor further acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay (1) is not caused, or could not have been anticipated, by the Contractor, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay, (3) prevents Contractor from completing its Work by the Contract Time, and (4) is of a duration not less than one (1) day. Delays attributable to and within the control of a Subcontractor or supplier shall not justify an extension of the Contract Time.

8.2.4 Notwithstanding anything to the contrary in the Contract Documents, except as otherwise noted in these General Conditions, an extension in the Contract Time, to the extent permitted under this Article, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity, or (4) other similar claims due to or caused by any events beyond the control of both the Owner and Contractor. In no event shall the Contractor be entitled to any compensation or recovery of any damages or any portion of damages resulting from delays caused by or within the control of Contractor or by acts or omissions of Contractor or its Subcontractors of any tier or delays beyond the control of both Owner and Contractor. If the Contractor contends that delay, hindrance, obstruction or other adverse condition results from acts or omissions of the Owner, the Owner’s Representative or the Architect, Contractor shall promptly provide written notice to the Owner. Contractor shall only be entitled to an adjustment in the Contract Sum to the extent that such acts or omissions continue after the Contractor's written notice to the Owner of such acts or omissions. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work) regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be the basis of any Claim for an increase in the Contract Sum or Contract

Authority: Contractor

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Time. In the event Contractor is entitled to an adjustment in the Contract Sum for any delay, hindrance, obstruction or other adverse condition caused by the acts or omissions of the Owner, the Owner’s Representative or the Architect, Contractor shall only be entitled to its actual direct costs caused thereby and Contractor shall not be entitled to and waives any right to special, indirect, or consequential damages including loss of profits, loss of savings or revenues, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar type of damages.

8.2.5 If the Contractor submits a progress report or any construction schedule indicating, or otherwise expressing an intention to achieve completion of the Work prior to any completion date required by the Contract Documents or expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied. Further, the Contractor acknowledges and agrees that even if Contractor intends or is able to complete the Work prior to the Contract Time, it shall assert no Claim and the Owner shall not be liable to Contractor for any failure of the Contractor, regardless of the cause of the failure, to complete the Work prior to the Contract Time.

8.3 Liquidated Damages

8.3.1 If Liquidated Damages are prescribed on the Bid Form and Special Conditions in the Contract Documents, the Owner may deduct from the Contract Sum and retain as Liquidated Damages, and not as penalty or forfeiture, the sum stipulated in the Contract Documents for each calendar day after the date specified for completion of the Work that the entire Work is not substantially complete and/or finally complete.

8.3.2 The Owner’s Representative shall establish the date of Substantial completion and the date of Final Completion of the Work which shall be conclusive and binding on the Owner and Contractor for the purpose of determining whether or not Liquidated Damages shall be assessed under terms hereof and the sum total amount due.

8.3.3 Liquidated Damages or any matter related thereto shall not relieve the Contractor or his surety of any responsibility or obligation under this Contract.

ARTICLE 9
PAYMENTS AND COMPLETION

9.1 Commencement, Prosecution, and Completion

9.1.1 The Contractor shall commence Work within five (5) days upon the date of a “Notice to Proceed” from the Owner or the date fixed in the Notice to Proceed. Contractor shall prosecute the Work with faithfulness and diligence, and the Contractor shall complete the Work within the Contract Time set forth in the Contract Documents.

9.1.2 The Owner will prepare and forward three (3) copies of the Contract and Performance Bond to the bidder to whom the contract for the Work is awarded and such bidder shall return two (2) properly executed prescribed copies of the Contract and Bond to the Owner.

9.1.3 The construction period, when specified in consecutive calendar days, shall begin when the Contractor receives notice requesting the instruments listed in below. Before the Owner will issue Notice to Proceed to permit the Contractor to begin Work, the Owner shall have received the following instruments, properly executed as described in the Contract Documents. The documents below shall have been received by the Owner within fifteen (15) days after receipt of request for documents:

.1 Contract
.2 Bond (See Article 11)
.3 Insurance (See Article 11)
.4 List of Subcontractors of any tier
.5 Affirmative Action Plan (see Article 13.4)

9.1.4 In the event Contractor fails to provide Owner such documents, Contractor may not enter upon the site of the Work until such documents are provided. The date the Contractor is required to commence and complete the Work shall not be affected by the Owner denying Contractor access to the site as a result of Contractor’s failure to provide such documents and Contractor shall not be entitled to an adjustment of the Contract Time or Contract sum as a result of its failure to comply with the provisions of this Paragraph.

9.1.5 Contracts executed by partnerships shall be signed by all general partners of the partnership. Contracts signed by corporations shall be signed by the President or Vice President and the Secretary or Assistant Secretary. In case the Assistant Secretary or Vice President signs, it shall be so indicated by writing the word "Asst." or "Vice" in front of the words "Secretary" and "President". The corporate seal of the corporation shall be affixed. For all other types of entities, the Contractor and the person signing the Contract on behalf of Contractor represent and warrant that the person signing the Contract has the legal authority to bind Contractor to the Contract.

9.1.6 Any successful bidder which is a corporation organized in a state other than Missouri or any bidder doing business in the State of Missouri under a fictitious name shall furnish, at no cost to the Owner, no later than the time at which the executed Contract for Construction, the Payment Bond, and the Performance Bond are returned, a properly certified copy of its current Certificate of Authority and License to do business in the State of Missouri. No contract will be executed by the Owner until such certificate is furnished by the bidder, unless there already is on file with
9.1.7 Within fifteen (15) calendar days of the issuance of a Notice to Proceed, the Contractor shall submit one (1) signed copy of the following instruments. No payment will be processed until all of these instruments are received and approved by the Owner’s Representative.

- Reproducible progress and payment schedule
- Contractor's Schedule of Values
- List of material suppliers
- Itemized breakdown of all labor rates for each classification. Overhead and profit shall not be included. Payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor or Subcontractors. Any item or expense outside of these categories is not allowed. The expense of performing Work after regular working hours, on Saturdays, Sundays or legal holidays shall not be included in the above, unless approved in writing and in advance by Owner.
- Itemized breakdown of anticipated equipment rates (breakout rate per hour). Overhead and profit shall not be included. Breakdown for required equipment shall itemize (at a minimum) delivery/ pick-up charge, hourly rate and hours used. Operator hours and rate shall not be included in the equipment breakdown. Contractor must use the most cost effective equipment available in the area and should not exceed the rates listed in the Rental Rate Blue Book for Construction Equipment (Blue Book). Contractor shall submit documentation for the Blue Book to support the rate being requested.

9.1.8 The Contractor shall be paid electronically using the Owner’s web-based payment program with a direct electronic transfer from the Owner’s account into the Contractor’s account. The Contractor must submit the following information to the Owner’s Representative:

- Bank Transit Number for the Contractor’s bank into which the electronic deposit will be made.
- Bank Account Number for the Contractor’s account into which the electronic deposit will be made.
- Contractor’s E-Mail address so that formal notification of the deposit by the Owner can be provided.

9.2 Contract Sum

9.2.1 The Owner shall compensate Contractor for all Work described herein and in the Contract Documents the Contract Sum set forth in the Contract for Construction, subject to additions and deletions as provided hereunder.

9.3 Schedule of Values

9.3.1 Within fifteen (15) days after receipt of the Notice to Proceed, the Contractor shall submit to the Owner’s Representative a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Owner’s Representative may require. This schedule, unless objected to by the Owner’s Representative, shall be used as a basis for reviewing the Contractor's Applications for Payment. The values set forth in such schedule may, at the Owner’s option be used in any manner as fixing a basis for additions to or deletions from the Contract Sum.

9.3.2 The progress and payment schedule of values shall show the following:

- Enough detail as necessary to adequately evaluate the actual percent complete of any line item on a monthly basis, as determined by the Owner’s Representative.
- Line items, when being performed by a subcontractor or material supplier, shall correlate directly back to the subcontract or purchase order amount if requested by the Owner’s Representative.

9.4 Applications for Payment

9.4.1 The Contractor shall submit monthly to the Owner’s Representative and the Architect an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be supported by such data substantiating the Contractor's right to payment as the Owner’s Representative or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage as provided for herein.

9.4.2 Such applications shall not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier.

9.4.3 Progress payments shall be made on account of materials and equipment delivered to the site and incorporated in the Work. No payments will be made for materials and equipment stored at the Project site but not yet incorporated into the Work except as provided in Paragraph 9.4.4.

9.4.4 If approved in writing and in advance by Owner, progress payments may be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. Owner may in its sole discretion refuse to grant approval for payments for materials and equipment stored at the Project site but not yet incorporated in the Work. Any approval by Owner for payment for materials and equipment delivered and suitably
The Owner's representative shall be provided a minimum of two weeks notice to visit the storage facility and inspect the stored material prior to submission of the pay request.

.7 Upon favorable inspection by the Owner's Representative, the Contractor shall, at the Owner's option, submit the appropriate UCC filing, transferring title of the material or equipment to The Curators of the University of Missouri.

.8 An invoice provided by the supplier shall be included with the applicable pay request.

.9 The contractor shall remain fully responsible for all items, until acceptance of the project by the Owner.

.10 The contractor shall reimburse all costs incurred by the Owner in inspecting and verifying all material stored offsite, including mileage, airfare, meals, lodging and time, charged at a reasonable hourly rate.

9.4.5 The Application for Payment shall constitute a representation by the Contractor to the Owner that the Work has progressed to the point indicated; the quality of the Work covered by the Application for Payment is in accordance with the Contract Documents; and the Contractor is entitled to payment in the amount requested.

9.4.6 The Contractor will be reimbursed for ninety-five percent (95%) of the value of all labor furnished and material installed and computed in the same manner, less all previous payments made. On projects where a bond is not required, the contractor will be reimbursed for ninety percent (90%) of the value of all labor furnished and material installed and computed in the same manner, less all previous payments made.

9.5 Approval for Payment

9.5.1 The Owner's Representative will, within fifteen (15) days after receipt of the Contractor's Application for Payment, either approve Contractor’s Application for Payment for such amount as the Owner’s Representative determines is properly due, or notify the Contractor of the Owner's Representative's reasons for withholding certification in whole or in part as provided in Section 9.6.

9.6 Decisions to Withhold Approval

9.6.1 The Owner’s Representative may decide not to certify payment and may withhold approval in whole or in part, to the extent reasonably necessary to protect the Owner. If the Owner’s Representative is unable to approve payment in the amount of the Application, the Owner’s Representative will notify the Contractor as provided in Paragraph 9.5.1. If the Contractor and Owner's Representative cannot agree on a revised amount, the Owner’s Representative will promptly issue approval for payment for the amount for which the Owner’s Representative is able to determine is due Contractor. The Owner’s Representative may also decide not to approve payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of approval for payment previously issued, to such extent as may...

stored at the site, or stored offsite as noted below, for subsequent incorporation in the Work shall be conditioned upon Contractor's demonstrating that such materials and equipment are adequately protected from weather, damage, vandalism and theft and that such materials and equipment have been inventoried and stored in accordance with procedures established by or approved by the Owner. Nothing in this clause shall imply or create any liability on the part of the Owner for the Contractor's inventory and storage procedures or for any loss or damage to material, equipment or supplies stored on the site, whether incorporated into the work or not. In the event any such loss or damage occurs, the Contractor remains solely responsible for all costs associated with replacement of the affected materials, supplies and equipment including labor and incidental costs, and shall have no claim against the Owner for such loss.

No allowance shall be made in the project pay requests for materials not delivered to the site of the work and incorporated into the work, except as noted below. For the purposes of this Article, Offsite is defined as any location not owned or leased by the Owner. Contractor shall submit a list of materials that they are requesting payment for offsite storage within 60 days of Notice Proceed.

.1 Items considered to be major items of considerable magnitude, if suitably stored, may be allowed in project pay requests on the basis of ninety percent (90%) of invoices

.2 Determination of acceptable “major items of considerable magnitude” and “suitably stored” shall be made by the Owner's Representative.

.3 Aggregate quantities of materials not considered unique to this project will not be considered for offsite storage payment.

.4 Contractor shall submit to the Owner’s Representative a list of the material for which application for payment for offsite storage is anticipated no less than forty-five days prior to the submission of the applicable pay request. The list shall include a material description, applicable division, quantity and discounts offered to the Owner for early payment. Contractor shall also submit the location the material will be stored and the method of protection.

.5 The storage facility shall be subject to approval by the Owner's representative, shall be located within an acceptable distance of the project sites as established by the Owner's Representative and all materials for the Owner's project must be stored separately from all other items within the storage facility and shall be labeled and stored in the name of the Curators of the University of Missouri.

.6 The Owner's representative shall be provided a minimum of two weeks notice to visit the storage facility and inspect the stored material prior to submission of the pay request.
be necessary in the Owner’s Representative opinion to protect the Owner from loss because of:

.1 defective Work not remedied or damage to completed Work;
.2 failure to supply sufficient skilled workers or suitable materials;
.3 third party claims filed or reasonable evidence indicating probable filing of such claims;
.4 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment, Owner may, at its sole option issue joint checks to subcontractors who have presented evidence that it has not been paid in accordance with the Contract;
.5 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.6 damage to the Owner or another contractor;
.7 reasonable evidence that the Work will not be completed within the Contract Time or an unsatisfactory rate of progress made by Contractor;
.8 Contractor’s failure to comply with applicable Laws;
.9 Contractor’s or Subcontractor’s failure to comply with contract Prevailing Wage requirements; or
.10 Contractor’s failure to carry out the Work in strict accordance with the Contract Documents.

9.6.2 When the above reasons for withholding approval are removed, approval will be made for amounts previously withheld.

9.7 Progress Payments
9.7.1 Based upon Applications for Payment submitted to the Owner by the Contractor and approvals issued by the Owner’s Representative, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

9.7.2 The period covered by each Application for Payment shall be one (1) calendar month.

9.7.3 The Owner shall make payment to Contractor for amounts due and approved by Owner’s Representative not later than thirty (30) days after the Owner approves a properly detailed Application for Payment which is in compliance with the Contract Documents. The Owner shall not have the obligation to process or pay such Application for Payment until it receives an Application for Payment satisfying such requirements.

9.7.4 Based on the Schedule of Values submitted by Contractor, Applications for Payment submitted by Contractor shall indicate the actual percentage of completion of each portion of Contractor’s Work as of the end of the period covered by the Application for Payment.

9.7.5 The Contractor shall promptly pay each Subcontractor and Supplier, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's or supplier's portion of the Work, the amount to which said Subcontractor or supplier is entitled, reflecting percentages actually retained from payments to the Contractor on account of each Subcontractor's or supplier's portion of the Work, in full compliance with state statute. The Contractor shall, by appropriate agreement with each Subcontractor or supplier, require each Subcontractor or supplier to make payments to Sub-subcontractors in similar manner.

9.7.6 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor of any tier nor a laborer or employee of Contractor except to the extent required by law. Retainage provided for by the Contract Documents are to be retained and held for the sole protection of Owner, and no other person, firm or corporation shall have any claim or right whatsoever thereto.

9.7.7 An approval for payment by Owner’s Representative, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.8 Failure of Payment
9.8.1 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, such payment by Contractor shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that to which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that to which the Owner is entitled.

9.9 Substantial Completion
9.9.1 Substantial Completion is the stage in the progress of the Work as defined in Paragraph 1.1.9 as certified by the Owner.

9.9.2 When the Contractor considers the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Owner and the Architect. The Owner’s Representative will make an inspection to determine whether the Work or designated
portion thereof is substantially complete. If the Owner’s Representative's inspection discloses any item which is not in accordance with the requirements of the Contract Documents, the Contractor shall complete or correct such item upon notification by the Owner’s Representative. The Contractor shall then submit a request for another inspection by the Owner’s Representative to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Owner will issue a Certificate of Substantial Completion. Substantial Completion shall transfer from the Contractor to the Owner responsibilities for security, maintenance, heat, utilities, damage to the Work and insurance. In no event shall Contractor have more than thirty (30) days to complete all items on the Punch List and achieve Final Completion. Warranties required by the Contract Documents shall commence on the date of Substantial Completion or as agreed otherwise.

9.9.3 At the date of Substantial Completion, the Contractor may apply for, and if approved by Owner’s Representative, the Owner, subject to the provisions herein, shall increase total payments to one hundred percent (100%) of the Contract Sum less one hundred fifty percent (150%) of the value of any incomplete Work and unsettled claims, as determined by the Owner’s Representative.

9.10 Partial Occupancy or Use
9.10.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retention, security, maintenance, heat, utilities, damage to the Work and insurance. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by the Owner’s Representative.

9.10.2 Immediately before such partial occupancy or use, the Owner, and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.11 Final Completion and Final Payment
9.11.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Owner’s Representative and the Architect will promptly make such inspection and, when the Owner’s Representative and Architect find the Work acceptable under the Contract Documents and the Contract fully performed, the Owner’s Representative will promptly issue a final approval for payment; otherwise, Owner’s Representative will return Contractor’s Final Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Submission of a Final Application for Payment shall constitute a further representation that conditions listed in Paragraph 9.11.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Owner’s Representative as part of the final Application for Payment. The final approval for payment will not be issued by the Owner’s Representative until all warranties and guarantees have been received and accepted by the Owner.

9.11.2 The Owner will request the Contractor to submit the application for final payment along with a manually signed notarized letter on the Contractor's letterhead certifying that:

1. Labor costs, prevailing wage rates, fringe benefits and material costs have been paid.
2. Subcontractors of any tier and manufacturers furnishing materials and labor for the project have fully completed their Work and have been paid in full.
3. The project has been fully completed in accordance with the Contract Documents as modified by Change Orders.
4. The acceptance by Contractor of its Final Payment, by check or electronic transfer, shall be and operate as a release of all claims of Contractor against Owner for all things done or furnished or relating to the Work and for every act or alleged neglect of Owner arising out of the Work.

9.11.3 Final Payment constituting the entire unpaid balance due shall be paid by the Owner to the Contractor within thirty (30) days after Owner's receipt of Contractor's Final Application for Payment which satisfies all the requirements of the Contract Documents and Owner’s receipt of all information and documents set forth in Section 9.11.

9.11.4 No payment under this Contract, including but not limited to final payment, shall constitute acceptance by Owner of any Work or act not in accordance with the requirements of the Contract Documents.

9.11.5 No recourse shall be had against any member of the Board of Curators, or officer thereof, for any payment under the Contract or any claim based thereon.

ARTICLE 10
PROTECTION OF PERSONS AND PROPERTY
10.1 **Safety Precautions and Programs**

10.1.1 The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.

10.1.2 All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.

10.1.3 In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. “Rendered Harmless” shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

10.2 **Safety Of Persons And Property**

10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:

1. students, faculty, staff, the public, construction personnel, and other persons who may be affected thereby;

2. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Article 10 caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under Article 10, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.

10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment, and enforce the use of such equipment by it's employees and it’s subcontractors of any tier.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
10.2.8 The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner.

10.2.9 The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.

ARTICLE 11
INSURANCE & BONDS

11.1 Insurance
11.1.1 Contractor shall secure from the date of the Contract for Construction and maintain for such periods of time as set forth below, insurance of such types and in such amounts specified below, to protect Contractor, Owner and others against all hazards or risks of loss described below. The form of such insurance together with carriers thereof, in each case, shall be approved by Owner, but, regardless of such approval, it shall be the responsibility of Contractor to maintain the insurance coverages set forth herein.

11.1.2 The contractor shall not be allowed on the Owners property without proof of the insurance coverages set forth herein.

11.2 Commercial General Liability
11.2.1 Contractor shall secure and maintain from the date of the Contract and for a period of at least five (5) years from the date of Final Completion of the entire Work Commercial General Liability insurance (“CGL”) with a combined single limit of not less than $2,000,000 per occurrence, $5,000,000 general aggregate, $5,000,000 products and completed operations aggregate and $1,000,000 personal injury and advertising injury. General Aggregate should apply per project. An umbrella policy may be used to satisfy these limits. If the General Aggregate is not on a per project basis, the contractor shall provide an additional $2,000,000 general aggregate.

11.2.2 CGL insurance shall be written on a comprehensive form and shall cover claims and liability in connection with or resulting from the Contractor’s operations and activities under the Contract, for personal injuries, occupational sickness, disease, death or damage to property of others, including loss of use resulting therefrom, arising out of any operations or activities of the Contractor, its agents, or any Subcontractors of any tier or by anyone directly or indirectly employed by either of them.

11.2.3 CGL insurance shall include premises, operations, independent contractors, products-completed operations, personal injury and advertising injury and liability assumed under an insured contract (including the tort liability of another assumed in a business contract) coverages. In particular, and not by way of any limitation, the CGL insurance shall cover the Contractor’s indemnity obligations contained in the Contract Documents.

11.2.4 There shall be no endorsement or modification of the CGL policy limiting the scope of coverage for liability arising from blasting, explosion, collapse, or underground property damage.

11.2.5 “The Curators of the University of Missouri” shall be endorsed as an “additional insured” under the CGL policy. The additional insured status must be conveyed by using the ISO CG 2 10 (2004) edition or equivalent and the ISO CG 20 37 (2004) edition. The policy shall be endorsed to be primary coverage and any other insurance carried by the Owner shall be excess only and will not contribute with Contractors’ insurance. To confirm, the Endorsement should accompany the insurance certificate.

11.2.6 Contractor waives all rights against Owner and its agents, officers, representatives and employees for recovery of damages to the extent those damages are covered by the CGL policy required hereunder.

11.3 Licensed for Use Vehicle Liability
11.3.1 Contractor shall secure and maintain from the date of the Contract for Construction until the date of Final Completion of the entire Work, insurance, to be on comprehensive form, which shall protect Contractor against any and all claims for all injuries and all damage to property arising from the use of automobiles, trucks and motorized vehicles, in connection with the performance of Work under this Contract, and shall cover the operation on or off the site of the Work of all motor vehicles licensed for highway use whether they are owned, non-owned or hired. Such insurance shall include contractual liability coverage and shall provide coverage on the basis of the date of any accident. The liability limits under such policy shall not be less than $2,000,000 combined single limit for bodily injury and property damage per accident.

11.3.2 Contractor waives all rights against Owner and its agents, officers, directors and employees for recovery of damages to the extent such damages are covered by the automobile liability insurance required hereunder.

11.4 Workers’ Compensation Insurance
11.4.1 Contractor shall purchase and maintain workers’ compensation insurance and employers’ liability insurance
which shall protect Contractor from claims for injury, sickness, disease or death of Contractor’s employees or statutory employees. The insurance policies required hereunder shall include an “all states” or “other states” endorsement. In case any Work is sublet, Contractor shall require any Subcontractor of any tier to provide the insurance coverages required under this Section 11.4.

11.4.2 Contractor’s workers’ compensation insurance coverage shall be in compliance with all applicable Laws, including the statutes of the State of Missouri. Contractor’s employers’ liability coverage limits shall not be less than $1,000,000 each accident for bodily injury by accident or $1,000,000 each employee for bodily injury by disease.

11.5 Liability Insurance General Requirements
11.5.1 All insurance coverages procured by Contractor shall be provided by agencies and insurance companies acceptable to and approved by Owner. Any insurance coverage shall be provided by insurance companies that are duly licensed to conduct business in the State of Missouri as an admitted carrier. The form and content of all insurance coverage provided by Contractor are subject to the approval of Owner. All required insurance coverages shall be obtained and paid for by Contractor. Any approval of the form, content or insurance company by Owner shall not relieve the Contractor from the obligation to provide the coverages required herein.

11.5.2 All insurance coverage procured by the Contractor shall be provided by insurance companies having policyholder ratings no lower than "A-" and financial ratings not lower than "XI" in the Best's Insurance Guide, latest edition in effect as of the date of the Contract, and subsequently in effect at the time of renewal of any policies required by the Contract Documents. Insurance coverages required hereunder shall not be subject to a deductible amount on a per-claim basis of more than $10,000.00 and shall not be subject to a per-occurrence deductible of more than $25,000.00. Insurance procured by Contractor covering the additional insureds shall be primary insurance and any insurance maintained by Owner shall be excess insurance.

11.5.3 All insurance required hereunder shall provide that the insurer’s cost of providing the insureds a defense and appeal, including attorneys’ fees, shall be supplementary and shall not be included as part of the policy limits but shall remain the insurer’s separate responsibility. Contractor shall cause its insurance carriers to waive all rights of subrogation, except for Workers’ Compensation, against the Owner and its officers, employees and agents.

11.5.4 The Contractor shall furnish the Owner with certificates, Additional Insured endorsements, policies, or binders which indicate the Contractor and/or the Owner and other Contractors (where required) are covered by the required insurance showing type, amount, class of operations covered, effective dates and dates of expiration of policies prior to commencement of the work. Contractor is required to maintain coverages as stated and required to notify the University of a Carrier Change or cancellation within 2 business days. The University reserves the right to request a copy of the policy. Contractor fails to provide, procure and deliver acceptable policies of insurance or satisfactory certificates or other evidence thereof, the Owner may obtain such insurance at the cost and expense of the Contractor without notice to the Contractor.

11.5.5 With respect to all insurance coverages required to remain in force and affect after final payment, Contractor shall provide Owner additional certificates, policies and binders evidencing continuation of such insurance coverages along with Contractor’s application for final payment and shall provide certificates, policies and binders thereafter as requested by Owner.

11.5.6 The maintenance in full current force and effect of such forms and amounts of insurance and bonds required by the Contract Documents shall be a condition precedent to Contractor’s exercise or enforcement of any rights under the Contract Documents.

11.5.7 Failure of Owner to demand certificates, policies and binders evidencing insurance coverages required by the Contract Documents, approval by Owner of such certificates, policies and binders or failure of Owner to identify a deficiency from evidence that is provided by Contractor shall not be construed as a waiver of Contractor’s obligations to maintain the insurance required by the Contract Documents.

11.5.8 The Owner shall have the right to terminate the Contract if Contractor fails to maintain the insurance required by the Contract Documents.

11.5.9 If Contractor fails to maintain the insurance required by the Contract Document, Owner shall have the right, but not the obligation, to purchase said insurance at Contractor’s expense. If Owner is damaged by Contractor’s failure to maintain the insurance required by the Contract Documents, Contractor shall bear all reasonable costs properly attributable to such failure.

11.5.10 By requiring the insurance set forth herein and in the Contract Documents, Owner does not represent or warrant that coverage and limits will necessarily be adequate to protect Contractor, and such coverages and limits shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.
11.5.11 If Contractor’s liability policies do not contain a standard separation of insureds provision, such policies shall be endorsed to provide cross-liability coverage.

11.5.12 If a part of the Work hereunder is to be subcontracted, the Contractor shall: (1) cover any and all Subcontractors in its insurance policies; (2) require each Subcontractor to secure insurance which will protect said Subcontractor and supplier against all applicable hazards or risks of loss designated in accordance with Article 11 hereunder; and (3) require each Subcontractor or supplier to assist in every manner possible in the reporting and investigation of any accident, and upon request, to cooperate with any insurance carrier in the handling of any claim by securing and giving evidence and obtaining the attendance of witnesses as required by any claim or suit.

11.5.13 It is understood and agreed that the insurance coverages required by the provisions of this Article 11 are required in the public interest and that the Owner does not assume any liability for acts of Contractor or Subcontractors of any tier or their employees in the performance of the Contract or Work.

11.6 Builder’s Risk Insurance

11.6.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the State of Missouri, as an admitted carrier, builder’s risk insurance on the entire Work. Such insurance shall be written on a completed value form for the entire Work. The insurance shall apply on a replacement cost basis.

11.6.2 The insurance as required herein shall name as insureds the Owner, Contractor and all Subcontractors of any tier. The insurance policy shall contain a provision that the insurance will not be canceled, allowed to expire or materially changed until at least thirty (30) days prior written notice has been given to Owner.

11.6.3 The insurance as required herein shall cover the entire Work, including reasonable compensation for Architect’s services and expenses made necessary by an insured loss. Insured property shall include portions of the Work located away from the site (including all offsite stored materials) but intended for use at the site, and shall also cover portions of the Work in transit, including ocean transit. The policy shall include as insured property scaffolding, falsework, and temporary buildings located at the site. The policy shall cover the cost of removing debris, including demolition as may be made legally necessary by the operation of any law, ordinance or regulation.

11.6.4 The insurance required herein shall be on an all risk form and shall be written to cover all risks of physical loss or damage to the insured party and shall insure at least against the perils of fire and extended coverage, theft, vandalism, malicious mischief, collapse, lightening, earthquake, flood, frost, water damage, windstorm and freezing.

11.6.5 If there are any deductibles applicable to the insurance required herein, Contractor shall pay any part of any loss not covered because of the operation of such deductibles.

11.6.6 The insurance as required herein shall be maintained in effect until the earliest of the following dates:

1. the date which all persons and organization who are insureds under the policy agree in writing that it shall be terminated;
2. the date on which final payment of this Contract has been made by Owner to Contractor; or
3. the date on which the insurable interests in the property of all insureds other than the Owner have ceased.

11.6.7 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors of any tier, suppliers, agents and employees, each of the other, (2) the Architect and Architect’s consultants, and (3) separate contractors described in Article 6, if any, and any of their subcontractors of any tier, suppliers, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Section 11.7 or other insurance applicable to the Work, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require of the Architect, Architect’s consultants, separate contractors described in Article 6, if any, and the subcontractors of any tier, suppliers, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, was at fault or was negligent in causing the loss and whether or not the person or entity had an interest in the property damaged.

11.6.8 A loss insured under Contractor’s property insurance shall be adjusted by the Owner in good faith and made payable to the Owner for the insureds, subject to requirements of the Contract Documents. The Contractor shall pay Subcontractors of any tier their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors of any tier to make payments to their Sub-subcontractors in similar manner.

11.7 Bonds

GC/31
08/18
11.7.1 When the Contract sum exceeds Fifty Thousand Dollars ($50,000), the Contractor shall procure and furnish a Performance Bond and a Payment Bond in the form prepared by the Owner, each in an amount equal to one hundred percent (100%) of the Contract Sum, as well as adjustments to the Contract Sum. The Performance Bond shall secure and guarantee Contractor's faithful performance of this Contract, including but not limited to Contractor's obligation to correct defects after final payment has been made as required by the Contract Documents. The Payment Bond shall secure and guarantee payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. These Bonds shall be in effect through the duration of the Contract plus the Guaranty Period as required by the Contract Documents.

11.7.2 The bonds required hereunder shall be executed by a responsible surety licensed in the State of Missouri, with a Best's rating of no less than A-/XI. The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of this power of attorney indicating the monetary limit of such power.

11.7.3 If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to conduct business in the State of Missouri is terminated, or it ceases to meet the requirements of this paragraph, Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to Owner. If Contractor fails to make such substitution, Owner may procure such required bonds on behalf of Contractor at Contractor's expense.

11.7.4 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds to such person or entity.

11.7.5 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety, as it relates to items one through four. The Owner may, in the Owner's sole discretion, inform surety of the progress of the Work, any defects in the Work, or any defaults of Contractor under the Contract Documents and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Work.

11.7.6 Contractor shall indemnify and hold harmless the Owner and any agents, employees, representative or member of the Board of Curators from and against any claims, expenses, losses, costs, including reasonable attorneys’ fees, as a result of any failure of Contractor to procure the bonds required herein.

ARTICLE 12
UNCOVERING AND CORRECTION OF THE WORK

12.1 Uncovering of the Work
12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it shall, if required in writing by the Architect or the Owner's Representative, be uncovered for the Architect's observation and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2 If a portion of the Work has been covered which the Architect or the Owner's Representative has not specifically requested to observe, prior to its being covered, the Architect or the Owner's Representative may request to see such Work, and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner will be responsible for payment of such costs.

12.2 Correction of the Work
12.2.1 The Architect or Owner's Representative shall have the right to reject Work not in strict compliance with the requirements of the Contract Documents. The Contractor shall promptly correct Work rejected by the Architect or the Owner's Representative for failing to conform to the requirements of the Contract Documents, whether observed before or after final completion and whether or not fabricated, installed, or completed. If Work has been rejected by Architect or Owner's Representative, the Architect or Owner's Representative shall have the right to require the Contractor to remove it from the Project site and replace it with Work that strictly conforms to the requirements of the Contract Documents regardless if such removal and replacement results in "economic waste." Contractor shall pay all claims, costs, losses and damages caused by or resulting from the correction, removal or replacement of defective Work, including but not limited to, all costs of repair or replacement of Work of others. The Contractor shall bear costs of correcting, removing and replacing such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby. If prior to the date of final payment, the Contractor, a Subcontractor or anyone for whom either is responsible uses or damages any portion of
the Work, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to “like new” condition at no expense to the Owner.

12.2.2 If, within twelve (12) months after the date of Final Completion of the Work or designated portion thereof, or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found not to be in strict accordance with the requirements of the Contract Documents, the Contractor shall correct or remove and replace such defective Work, at the Owner’s discretion. Such twelve (12) month period is referred to as the “Guarantee Period.” The obligations under this Paragraph 12.2.2 shall cover any repairs, removal and replacement to any part of the Work or other property caused by the defective Work.

12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct or remove it and replace such nonconforming Work. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Owner, the Owner may take action to correct or remove the nonconforming work at the contractor’s expense.

12.2.5 The Contractor shall bear the cost of correcting destroyed or damaged Work or property, whether completed or partially completed, of the Owner or of others caused by the Contractor’s correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.6 Nothing contained in Article 12 shall be construed to establish a period of limitation with respect to other obligations that the Contractor might have under the Contract Documents. Establishment of the twelve (12) month Guarantee Period as described in Article 12 relates only to the specific obligation of the Contractor to correct, remove or replace the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations under the Contract Documents. The requirements of Article 12 are in addition to and not in limitation of any of the other requirements of the Contract for warranties or conformance of the Work to the requirements of the Contract Documents.

12.3 Acceptance of Nonconforming Work

12.3.1 The Owner may accept Work which is not in accordance with the Contract Documents, instead of requiring its removal and correction, in its sole discretion. In such case the Contract Sum will be adjusted as appropriate and equitable. Such adjustment shall be made whether or not final payment has been made. Nothing contained herein shall impose any obligation upon the Owner to accept nonconforming or defective Work.

ARTICLE 13
MISCELLANEOUS PROVISIONS

13.1 Written Notice

13.1.1 All notices required to be given by the contractor under the terms of this Contract shall be made in writing. Written notice when served by the Owner will be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an office of the corporation for which it was intended, or if delivered at or sent to the last business address known to the party giving notice.

13.2 Rights and Remedies

13.2.1 Duties and obligations imposed by the Contract Documents, and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

13.2.2 No action or failure to act by the Owner, the Architect, or the Owner’s Representative will constitute a waiver of a right or duty afforded to the Owner under the Contract Documents, nor will such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.2.3 The terms of this Contract and all representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Work and shall remain in effect so long as the Owner is entitled to protection of its rights under applicable law.

13.2.4 Contractor shall carry out the Work and adhere to the current construction schedule during all disputes or disagreements with the Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements except as the Owner and Contractor may otherwise agree to in writing.
13.3 Tests and Inspections

13.3.1 Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules or regulations shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, and shall bear related costs of tests, inspections, and approvals. The Contractor shall give the Architect and the Owner's Representative timely notice of when and where tests and inspections are to be made so the Architect and/or the Owner's Representative may observe procedures.

13.3.2 If the Architect or the Owner's Representative determine that portions of the Work require additional testing, inspection or approval not included in the Contract Documents, or required by law, the Architect, or the Owner's Representative will instruct the Contractor to make arrangements for such additional testing, inspection, or approval by an entity acceptable to the Owner's Representative and the Contractor shall give timely notice to the Architect, and the Owner's Representative, of when and where tests and inspections are to be made so the Architect and/or the Owner's Representative may observe such procedures. The Owner will bear such costs except as provided elsewhere in Article 13.

13.3.3 If such procedures for testing, inspection, or approval under Article 13 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses.

13.3.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Owner's Representative and Architect.

13.3.5 Contractor shall take all necessary actions to ensure that all tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.3.6 Contractor shall arrange for and pay for all costs of all testing required by the Contract Documents or any applicable Laws for materials to be tested or certified at or on the place or premises of the source of the material to be supplied. The Owner shall have the right to require testing of all materials at the place of the source of the material to be supplied if not required by the Contract Documents or any applicable Laws. The Owner shall bear the costs of such tests and inspections not required by the Contract Documents or by applicable Laws unless prior defective Work provides Architect or Owner with a reasonable belief that additional defective Work may be found, in which case Contractor shall be responsible for all costs of tests and inspections ordered by the Owner or Architect, whether or not such tests or inspection reveals that Work is in compliance with the Contract Documents.

13.4 Nondiscrimination in Employment Equal Opportunity

13.4.1 The University serves from time to time as a contractor for the United States government. Accordingly, the provider of goods and/or services shall comply with federal laws, rules and regulations applicable to subcontractors of government contracts including those relating to equal employment opportunity and affirmative action in the employment of minorities (Executive Order 11246), women (Executive Order 11375), persons with disabilities (29 USC 706) and Executive Order 11758, and certain veterans (38 USC 4212 formerly [2012]) contracting with business concerns with small disadvantaged business concerns (Publication L. 95-507). Contract clauses required by the Government in such circumstances are incorporated herein by reference.

13.5 Supplier Diversity Goal Program

13.5.1 The Contractor shall subcontract with diverse firms no less than the amount pledged in the Contractor's Bid and/or the amount accepted by the Owner.

13.5.2 If the Contractor must remove any diverse subcontractor of any tier, the Contractor shall replace the diverse subcontractor of any tier with another diverse subcontractor(s) of equal dollar value to the diverse supplier removed. The Contractor shall immediately notify the Owner’s Representative in writing of the Contractor’s intent to remove any, and the Contractor’s plan to maintain subcontracts with diverse firms of no less than amount pledged in the Contractor’s Bid and/or the amount accepted by the Owner. All changes of diverse subcontractor of any tier shall be approved by the Director of Facilities Planning & Development.

13.5.3 If the Contractor fails to meet or maintain the contractor’s Supplier Diversity subcontracting pledge, the Contractor shall immediately notify in writing the Owner’s Representative, and the Director of Facilities Planning & Development. Such notice shall include a description of the Contractor’s good faith effort to comply with their Supplier Diversity subcontracting pledge.

13.5.4 If the Director of Facilities Planning & Development finds the Contractor has failed to comply in good faith with the Owner’s Supplier Diversity goal program, the Director may take appropriate action, including but not limited to, declaring the Contractor ineligible to participate in any contracts with the Owner for a period not to exceed six (6) months, and/or directing that the Contractor's actions be
declared a material breach of the Contract and that the Contract be terminated.

13.5.5 The Contractor and his subcontractors shall develop, implement, maintain, and submit in writing to the Director of Facilities Planning & Development, an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed "Affidavit for Affirmative Action" in the form as included in the Contract Documents. For the purpose of this section, an "Affirmative Action Program" means positive actions to influence all employment practices (including, but not limited to, recruiting, hiring, promoting, and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between 40 and 70), disabled and Vietnam-era veteran status, and handicapped otherwise qualified status. Such affirmative action program shall include:

.1 A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination.

.2 The identification of a person designated to handle affirmative action.

.3 The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion, and discipline.

.4 The exclusion of discrimination from collective bargaining agreements.

.5 Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

13.5.6 In the enforcement of this non-discrimination requirement, the Owner may use any reasonable procedures available, including but not limited to: requests, reports, site visits, and inspection of relevant documents of Contractors and Subcontractors of any tier. The contractor shall submit a final Affidavit of Supplier Diversity Participation for each diverse firm at the end of the project stating the actual amount paid to the diverse firm.

13.6 Wage Rates (If the contract amount is less than $75,000, the requirements of this section will not apply. Any contract adjustments that increase the contract above $75,000 will be subject to this section.)

13.6.1 The Contractor shall pay workers employed in the execution of this contract in full each week and not less than the predetermined wage rates and overtime for work of a similar character that have been made a part of this Contract. These rates are determined by the University of Missouri Director of Facilities Planning and Development. The rates are based on wage rates published in the Annual Wage Orders of the Missouri Department of Labor and Industrial Relations (MDLIR). The Contractor is to use MDLIR 8 CSR 30-3.020; .030; .040; .060 in determining the appropriate occupational titles and rates for workers used in the execution of this contract. All determinations and/or interpretations regarding wage rates and classification of workers will be made by the office of the University of Missouri Director of Facilities Planning and Development. The Contractor is responsible for the payment of the aggregate of the Basic Hourly Rate and the Total Fringe Benefits to the workers on the project. Fringe benefit payments may be made to the worker in cash, or irrevocably made by a Contractor or Subcontractor to a trustee or to a third person pursuant to a fund, plan or program, or pursuant to an enforceable commitment, or any combination thereof, to carry out a financially responsible plan or program which was communicated in writing to the workmen affected, for medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing, for unemployment benefits, life insurance, disability and sickness insurance, accident insurance, for vacation and holiday pay, for defraying costs of apprenticeship or other similar programs, or for other bona fide fringe benefits, but only where the Contractor or Subcontractor is not required by other federal or state law to provide any of the benefits as referenced in §290.210(5) RSMo 1994. Pay for travel, mileage, meals, bonuses, or other expenses are not fringe benefits and cannot be considered part of the workers wage rate. The Contractor shall not make any deductions for food, sleeping accommodations, transportation, use of small tools, uniforms, or anything of any kind or description, unless the Contractor and employee enter into an agreement in writing at the beginning of the worker’s term of employment, and such agreement is approved by the Owner. In the event the contract contains more than one wage determination the Contractor shall comply with both.

13.6.2 The Contractor shall submit to the Owner with the Contractor’s periodic pay request, certified payroll records for labor performed by the Contractor and Subcontractors of any tier. The Contractor shall submit all required certified payroll information records electronically in pdf format using the Owner’s web-based payment program. The certified payroll forms shall contain the name, address, personal identification number, and occupational title of the workers as well as the hours they work each day. The Owner’s acceptance of certified payroll records does not in any way relieve the Contractor of any responsibility for the payment of prevailing wages to workers on the project. The Contractor shall also maintain copies of the certified payroll.
provisions of Article 13.6 would be and is difficult to delays, of additional work for Owner's staff and legal requirements of Article 13.6 result in additional costs to been completed. The liquidated damages and other provisions of this Article 13.6. Such liquidated damages shall be payable to the Owner at the demand of the Owner.

13.6.7 The Contractor shall specifically incorporate the obligations of Article 13 into the subcontracts, supply agreements and purchase orders for the Work and require the same of any Subcontractors of any tier.

13.6.8 Contractor acknowledges and recognizes that a material factor in its selection by the Owner is the Contractor's willingness to undertake and comply with the requirements of this Article 13.6. If Contractor fails to comply with the provisions of this Article 13.6, Owner may, in its sole discretion, immediately terminate the Contract upon written notice. The rights and remedies of Owner provided herein shall not be exclusive and are in addition to other rights and remedies provided by law or under this Contract.

13.6.9 Only such workers who are individually registered in a bona fide apprenticeship program approved by the U.S. Department of Labor, Office of Apprenticeship can be paid less than the journeyperson rate of pay. “Entry Level Workers; must be registered apprentices. The apprenticeship ratio will be one to one with a journeyperson of the same classification. Any worker not registered as an apprentice per this section will be paid as a journeyperson.

13.6.10 The Contractor shall post the wage rates for the contract in a conspicuous place at the field office on the project. On projects where there is no field office the Contractor may post the wage rates at their local office, as long as they provide a copy of the wage rates to a worker upon request. The wage rates shall be kept in a clearly legible condition for the duration of the project.

13.6.11 Neither the Contractor, nor any Subcontractor of any tier, nor any person hired by them or acting on their behalf, shall request or demand that workers pay back, return, donate, contribute or give any part, or all, of said workers wages, salary, or any thing of value, upon the statement, representation or understanding that failure to comply with such request or demand will prevent such worker from procuring or retaining employment. The exception being to an agent or representative of a duly constituted labor organization acting in the collection of dues or assessments of such organization.
13.6.12 No contractor or subcontractor may directly or indirectly receive a wage subsidy, bid supplement, or rebate for employment on this project if such wage subsidy, bid supplement, or rebate has the effect of reducing the wage rate paid by the employer on a given occupational title below the prevailing wage rate as provided in contract. In the event a wage subsidy, bid supplement, or rebate is provided or received, the entity receiving such subsidy, supplement, or rebate shall report the date and amount of such subsidy, supplement, or rebate to the University within thirty days of receipt of payment. This disclosure report shall be a matter of public record. Any employer not in compliance with this Article shall owe to the University double the dollar amount per hour that the wage subsidy, bid supplement, or rebate has reduced the wage rate paid by the employer below the prevailing wage rate for each hour that work was performed.

13.6.13 Time and one half overtime will be paid on all hours over 10 hours per day or 40 hours per week. The wage rate is the total of the “Basic Hourly Rate” plus “Total Fringe Benefits” or the “public works contracting minimum wage”. For all work performed on a Sunday or Holiday, not less than twice the prevailing hourly rate of pay or public works contracting minimum wage will apply. Holidays are as follows: January first, the last Monday in May, July fourth, the first Monday in September, November 11, the fourth Thursday in November, December twenty-fifth. If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

13.7 Records

13.7.1 The Owner, or any parties it deems necessary, shall have access to and the right to examine any accounting or other records of the Contractor involving transactions and Work related to this Contract for five (5) years after final payment or five (5) years after the final resolution of any on going disputes at the time of final payment. All records shall be maintained in accordance with generally accepted accounting procedures, consistently applied. Subcontractors of any tier shall be required by Contractor to maintain records and to permit audits as required of Contractor herein.

13.8 Codes and Standards

13.8.1 The Work shall be performed to comply with the International Code Council (ICC) Codes, and the codes and standards noted below. The latest editions and supplements of these Codes and Standards in effect on the date of the execution of the Contract for Construction shall be applicable unless otherwise designated in the Contract Documents. Codes and standards required by accreditation agencies will also be used unless the ICC requirements are more stringent. In the event that special design features and/or construction systems are not covered in the ICC codes, the applicable edition of the National Fire Protection Association (NFPA) family of standards and/or the NFPA 101 Life Safety Code shall be used.

13.9 General Provisions

13.9.1 Any specific requirement in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and are also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

13.9.2 This Contract shall be interpreted, construed, enforced and regulated under and by the laws of the State of Missouri. Whenever possible, each provision of this Contract shall be interpreted in a manner as to be effective and valid under applicable law. If, however, any provision of this Contract, or a portion thereof, is prohibited by law or found invalid under any law, only such provision or portion thereof shall be ineffective, without invalidating or affecting the remaining provisions of this Contract or valid portions of such provision, which are hereby deemed severable. Contractor and Owner further agree that in the event any provision of this Contract, or a portion thereof, is prohibited by law or found
invalid under any law, this Contract shall be reformed to replace such prohibited or invalid provision or portion thereof with a valid and enforceable provision which comes as close as possible to expressing the intention of the prohibited or invalid provision.

13.9.3 Contractor and Owner each agree that the State of Missouri Circuit Court for the County where the Project is located shall have exclusive jurisdiction to resolve all Claims and any issue and disputes between Contractor and Owner. Contractor agrees that it shall not file any petition, complaint, lawsuit or legal proceeding against Owner in any other court other than the State of Missouri Circuit Court for the County where the Project is located.

13.9.4 Owner’s total liability to Contractor and anyone claiming by, through, or under Contractor for any Claim, cost, loss, expense or damage caused in part by the fault of Owner and in part by the fault of Contractor or any other entity or individual shall not exceed the percentage share that Owner’s fault bears to the total fault of Owner, Contractor and all other entities and individuals as determined on the basis of comparative fault principles.

13.9.5 Contractor agrees that Owner shall not be liable to Contractor for any special, indirect, incidental, or consequential damage whatsoever, whether caused by Owner’s negligence, fault, errors or omissions, strict liability, breach of contract, breach of warranty or other cause or causes whatsoever. Such special, indirect, incidental or consequential damages include, but are not limited to loss of profits, loss of savings or revenue, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar types of damages.

13.9.6 Nothing contained in this Contract or the Contract Documents shall create any contractual relationship with or cause of action in favor of a third party against the Owner.

13.9.7 No member or officer of the Board of Curators of the University incurs or assumes any individual or personal liability under the Contract or by reason of the default of the Owner in the performance of any terms thereof. Contractor releases and discharges all members or officers of the Board of Curators of the University from any liability as a condition of and as consideration for the award of the Contract to Contractor.

13.9.8 The Contractor hereby binds itself, its partners, successors, assigns and legal representatives to the Owner in respect to covenants, agreements and obligations contained in the Contract Documents. Contractor shall not assign the Contract or proceeds hereof without written consent of the Owner. If Contractor attempts to make such an assignment without such consent, it shall be void and confer no rights on third parties, and Contractor shall nevertheless remain legally responsible for all obligations under the Contract. The Owner’s consent to any assignment is conditioned upon Contractor entering into a written assignment which contains the following language: “it is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor and to claims and to liens for services rendered or materials supplied for the performance of the Work required in said Contract in favor of all persons, firms, corporations rendering such services or supplying such materials.”

13.10 Debarment and Suspension Certification
The contractor certifies to the best of its knowledge and belief that it and its principals are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency in accordance with Executive Order 12549 (2/18/86).

ARTICLE 14
TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 Termination by Owner for Cause
14.1.1 In addition to other rights and remedies granted to Owner under the Contract Documents and by law, the Owner may terminate the Contract if the Contractor:

1. refuses or fails to supply enough properly skilled workers, superintendents, foremen, or managers;
2. refuses or fails to supply sufficient or proper materials;
3. fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
4. disregards laws, ordinances, rules, or regulations or orders of a public authority having jurisdiction;
5. disregards the authority of the Owner’s Representative or Architect;
6. breaches any warranty or representations made by the Contractor under or pursuant to the Contract Documents;
7. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
8. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents;
9. fails to maintain a satisfactory rate of progress with the Work or fails to comply with approved progress schedules; or
10. violates in any substantial way any provisions of the Contract Documents.

14.1.2 When any of the above reasons exist, the Owner may, without prejudice to any other rights or remedies of the Owner,
terminate this Contract by delivering a written notice of termination to Contractor and Contractor’s surety, and may:

.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 accept assignment of subcontracts pursuant to Paragraph 5.3; and

.3 finish the Work by whatever reasonable method the Owner may deem expedient, including turning the Work over to the surety.

14.1.3 The Contractor, in the event of a termination under Section 14.1, shall not be entitled to receive any further payments under the Contract until the Work is completed in its entirety. Then, if the unpaid balance under the Contract shall exceed all expenses of the Owner in finishing the Work, including additional compensation for the Architects services and expenses made necessary thereby, such excess will be paid to the Contractor; but, if such expenses of Owner to finish the Work shall exceed the unpaid balance, the Contractor and its surety shall be liable for, and shall pay the difference and any damages to the Owner. The obligation of the Contractor and its surety for payment of said amounts shall survive termination of the Contract.

14.1.4 In exercising the Owner's right to secure completion of the Work under any of the provisions hereof, the Owner shall have the right to exercise the Owner's sole discretion as to the manner, methods, and reasonableness of costs of completing the Work.

14.1.5 The rights of the Owner to terminate pursuant to Article 14.1 will be cumulative and not exclusive and shall be in addition to any other remedy provided by law or the Contract Documents.

14.1.6 Should the Contractor fail to achieve Final Completion of the Work within thirty (30) calendar days following the date of Substantial Completion, the Owner may exercise its rights under Article 14.1.

14.2 Suspension by the Owner for Convenience

14.2.1 The Owner may, without cause, order the Contractor in writing to suspend, delay, or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.2.2 An adjustment will be made to the Contract Sum for increases in the cost of performance of the Contract caused by suspension, delay or interruption. However, in the event of a suspension under this Article 14.2, Contractor hereby waives and forfeits any claims for payment of any special, indirect, incidental or consequential damages such as lost profits, loss of savings or revenue, loss of anticipated profits, idle labor or equipment, home office overhead, and similar type damages. No adjustment will be made to the extent:

.1 that performance is, was, or would have been so suspended, delayed or interrupted by another cause for which the Contractor in whole or in part is responsible, or

.2 that an equitable adjustment is made or denied under another provision of this Contract.

14.3 Owner’s Termination for Convenience

14.3.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this Paragraph shall be by a notice of termination delivered to the Contractor specifying the extent of termination and the effective date.

14.3.2 Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

.1 cease operation as specified in the notice;

.2 place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete Work not terminated;

.3 terminate all subcontracts and orders to the extent they relate to the Work terminated;

.4 proceed to complete the performance of Work not terminated; and

.5 take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

14.3.3 Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions and for all Owner approved claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors and suppliers. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits, consequential damages and other economic losses.

14.3.4 The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work, (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

14.3.5 Upon determination by a court that termination of Contractor or its successor in interest pursuant to Paragraph 14.1 was wrongful, such termination will be deemed converted
to a termination for convenience pursuant to Paragraph 14.3, and Contractor's sole and exclusive remedy for wrongful termination is limited to recovery of the payments permitted for termination for convenience as set forth in Paragraph 14.3.
SECTION 1.E

SPECIAL CONDITIONS

1. DEFINITIONS

a. "Drawings"

Drawings referred to in and accompanying Project Manual consist of Drawings prepared by and bearing name of below defined Architect, bearing Date of January 14, 2020, entitled "Loeb Hall – Building Demolition", project number CP181011.

b. Architect / Engineer

Planning, Design, and Construction
Campus Facilities
University of Missouri
Columbia, MO 65211
(573) 882-6800

c. Other Definitions: See Article 1., General Conditions.

2. SPECIAL SCHEDULING REQUIREMENTS

a. Contractor may mobilize no earlier than March 02, 2020.

b. Work shall be continuous with no down time.

c. Normal working hours are defined as weekdays between the hours of 7:00 AM and 5:00 PM.

d. All required outages and demolition work shall be scheduled no less than two weeks in advance and confirmed with Owner a minimum of seventy-two (72) hours in advance prior to starting work. Contractor shall minimize the number of outages, minimize the length of outages and related work shall be continuous until the utility is restored.

e. Contractor shall schedule coordination meetings with the Owner and Owner's Engineer at least two weeks prior to the start of construction. Contractor is responsible for maintain meeting minutes and uploading them to Projex4 (or other approved construction document management software).

3. SCOPE OF WORK

a. The Contractor shall furnish all labor, materials, tools, equipment necessary for, and incidental to, construction of this project as indicated on Drawings and specified herein.
b. Work shall include everything requisite and necessary to finish work properly, notwithstanding that every item of labor or materials or accessories required to make project complete may not be specifically mentioned.

c. General Description of Work:

(1) Project consists of demolition of Loeb and relocating existing utilities currently routing through Loeb. In addition, steam/steam condensate piping located within steam chase between existing steam utility hole [SMH-001] and Loeb shall be replaced.

(2) Demolition shall consist of demolishing Loeb and minor demolition work in McReynolds Hall and McDavid Hall.

(3) Structural work shall consist of modifications to the basement/foundation of Loeb to convert southeast corner of Loeb to new steam utility hole [SMH-049].

(4) Mechanical work shall consist of relocating utilities currently routing through Loeb including steam/steam condensate, chilled water supply/return, compressed air and campus energy management system. In addition, provide modifications to the steam/steam condensate piping located with McReynolds Hall and McDavid Hall, and replace the steam/steam condensate piping located within steam chase between existing SMH-001 and Loeb.

(5) Electrical work shall consist of disconnecting power from Loeb and providing power to miscellaneous equipment in McReynolds Hall, site lighting and existing steam utility hole [SMH-001].

4. LOCATION

a. Work shall be performed under this Contract on campus of the University of Missouri - Columbia, at Loeb Hall, 303 S. 6th Street

5. NUMBER OF CONSTRUCTION DOCUMENTS

a. The Owner’s Representative will furnish the Contractor electronic (pdf) copies of executed Contract and complete sets of Drawings and Specifications.

6. SUBMITTALS

a. The Contractor shall submit for approval to the Architect, equipment lists and Shop Drawings, as expediently as possible. Failure of the Contractor
to submit Shop Drawings in a timely manner will result in the Owner holding back Contractor payments. (See General Conditions)

b. The material and equipment lists shall be submitted and approved before any material or equipment is purchased and shall be corrected to as-built conditions before the completion of the project.

c. The Contractor shall submit electronic versions of all required Shop Drawings, material and equipment lists. The Contractor shall upload all Shop Drawings to a secure information sharing website determined by the Owner notifying the Owner and Consultant that these shop drawings are available for review. Each submittal shall have the General Contractors digital stamp affixed to the first page signifying their review and acceptance. Review comments, approvals, and rejections will be posted on this same site with notification to the contractor. Submittals requiring a professional seal shall be submitted hard copy with a manual seal affixed.

(1) The Contractor shall identify each submittal item with the following:

(a) Project Title and Location
(b) Project Number
(c) Supplier’s Name
(d) Manufacturer’s Name
(e) Contract Specification Section and Article Number
(f) Contract Drawing Number
(g) Acrobat file name: Spec Section_Times Submitted-Spec Title: (Example - 033000 _01-Cast In Place Concrete.pdf)

(2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.2) for required submittal information.

d. The Contractor shall submit to the Engineer one (1) electronic copy, in PDF form of all required Operating Instructions and Service Manuals with one PDF file per specification division for the Architect’s and the Owner’s sole use prior to completing 50% of the adjusted contract. Payments beyond 50% of the contract amount may be withheld until all Operating Instructions and Service Manuals are received as referenced in the accompanying Operating Instructions and Service Manual Log at the end of this section (1.E.3).

e. The Contractor shall submit to the Owner’s Representative all items referenced in the accompanying Closeout Log (1.E.4) within 30 days following substantial completion of the work. The Owner’s Representative will maintain the closeout log and include as an agenda item at all coordination meetings.
7. **NOTIFICATION**

a. Before beginning Demolition Work or service outages, the Contractor shall provide, at minimum, seventy-two (72) hours advance notice to Owner’s Representative for purpose of verifying utility locations including, but not limited to, gas, telecommunications, electric, water, steam, sewer, and nitrogen. Contractor shall minimize the number of outages, minimize the length of outages and related work shall be continuous until the utility is restored.

8. **USE OF PREMISES**

a. Access: Access to construction site shall be as indicated on Drawings and as directed by the Owner’s Representative.

b. Parking:

   (1) The Owner will issue Contractor two (2) service vehicle parking permits for use in University Parking lot RC9. The permits will be issued at no cost to the contractor up to the contract completion date. After the contract completion date, the permits will be re-issued on an as available basis at the contractors’ expense. These permits are to be used for general contractor or subcontractor owned and labeled vehicles only. Personal vehicles are prohibited from use of these permits. Violation of this requirement may result in ticketing and/or towing at the vehicle owner’s expense and suspension of progress payments.

   (2) Parking of personal vehicles within project access/lay down/staging areas is prohibited. Violation of this requirement may result in ticketing and/or towing at the vehicle owner’s expense and suspension of progress payments.

   (3) Parking or driving on sidewalks, landscaped areas, within fire and service lanes or generally in areas not designated for vehicular traffic is prohibited except as allowed in the contract documents. Violation of this requirement may result in ticketing and/or towing at the vehicle owner’s expense and suspension of progress payments.

   (4) Free parking for contractor employees is available in the Ashland Road Contractor lot on an as available basis. This space is for use by contractor employees for parking their personal vehicles only and is not to be used for staging or storage.

   (5) Vendor Permits may be purchased by contractor management personnel on an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure. These permits will allow contractor management personnel to park in
various University lots while conducting business on University construction projects.

(6) Temporary University parking permits may be purchased by contractor employees for use with their personal vehicles on an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure.

(7) Conley Avenue between Missouri Avenue and University Avenue and Hitt Street between University Avenue and the Memorial Union are designated for pedestrian use only during the work week between the hours of 8:15 AM and 3:45 PM. Unless otherwise indicated in the contract documents, this area is strictly off limits to vehicular traffic without authorization from the Owner's Representative.

c. Storage of materials: The Contractor shall store all materials within project limits. The Contractor shall confine apparatus, materials, and operation of workers to location established by the Owner's Representative. The Contractor shall not unreasonably encumber premises with materials. In addition, storage trailer locations may be available within 1-1/2 miles of project site as directed by the Owner's Representative. Storage trailer locations shall be subject to approval by the Owner's Representative and are available to the Contractor without cost.

d. Utilities: Drinking water, water required to carry on work, and 120 volt electrical power required for small tool operation may be obtained without cost to the Contractor from existing utilities at locations designated by the Owner's Representative. Provisions for obtaining power, including temporary extensions, shall be furnished and maintained by the Contractor. Upon completion of work such extensions shall be removed and any damage caused by use of such extensions shall be repaired to satisfaction of the Owner's Representative, at no cost to the Owner.

e. Restroom: The Contractor shall provide and maintain, in a sanitary condition, chemical type portable toilet facilities at work site for use by his personnel. Toilets and toilet location shall be subject to approval by the Owner's Representative.

f. Smoking is prohibited at the University of Missouri and all properties owned, operated, leased or controlled by the University of Missouri. Violation of the policy is defined as smoking any tobacco products, including e-cigarettes.

g. Landfill: The Contractor shall not use the Owner’s landfill. Dumping or disposal of excavated or demolition materials on Owner’s property shall not be permitted. The Contractor shall remove and legally dispose of excavated or demolished materials off the Owner’s property.
h. Care of Project Work Site: The contractor shall be responsible for maintaining the construction site in a reasonably neat and orderly condition by regular cleaning and mowing of the premises as determined by the Owner’s Representative.

i. Discharge to Sewer Request: The University of Missouri’s MS4 permit and NPDES Storm Water Discharge Permits along with the City of Columbia’s POTW Operating Permit as well as local ordinances, and state and federal environmental regulations prohibit hazardous materials from being disposed into either the storm water or sanitary sewer systems. Unless specifically approved, all chemical products such as paints, dyes, lawn care products, maintenance products, and oil is are prohibited from drain disposal. Any product, including contaminated water, being discarded into the storm water or sanitary sewer systems requires written approval from the Owner through a formal “Discharge to Sewer Request” form obtained at Discharge to Sewer Request Form. The contractor should submit the form to the Owner’s Representative, not to the Department of Environmental Health and Safety as the form indicates.

j. All concrete waste material including washout water shall be totally contained and removed from the Owner’s property.

k. Artifacts Found During Construction: Contractor shall immediately notify the Owner’s Representative when artifacts are uncovered or found during the demolition or construction process. Artifacts include, but are not limited to, tools, drawings (construction or other), photographs, books and other objects/devices which may hold historical importance/significance. Do not remove or disturb the object(s) in question. Artifacts are not considered part of demolished materials and shall remain the property of the University of Missouri.

l. Permit Required Confined Space Entry Communication and Coordination:

(See OSHA 1926 subpart aa – Construction Confined Space for the definition of “permit required confined spaces” - Note: OSHA does not apply to the University. However, the University will provide a list of all known “permit required confined spaces”)

The following are the known locations of “permit required confined spaces” currently identified within the project limits:

(1) SMH-049

The hazards or potential hazards in each “permit required confined space” or the reason it is a “permit required confined space”:

(1) Air quality, elevated temperatures, access egress.
Any precautions that the Owner or previous contractors have implemented for the protection of employees in the “permit required controlled space”:

(1) Air monitor, ventilation, and proper personal protective equipment.

The above list of known confined spaces within the project limits may not be a complete listing. Each contractor shall survey the project to identify all confined spaces. It is incumbent upon each contractor to list all “permit required spaces”.

The Contractor shall notify the Owner’s Representative if 1) conditions change resulting in a non-permit required confined space being reclassified to a “permit required confined space” after evaluation of the space by a competent person; 2) a space previously thought to be non-permit required space is classified as a “permit required confined space” after evaluation by a competent person; or 3) during the course of construction a “permit required confined space” is created after evaluation by a competent person.

The Contractor shall submit to the Owner’s Representative a copy of the cancelled confined space entry permit and a written report summarizing the permit space program followed and all hazards confronted or created during entry operations. This information shall be submitted within one week of cancelling the permit.

9. PROTECTION OF OWNER'S PROPERTY

a. The Contractor shall be responsible for repair of damage to building exterior and interior, drives, curbs, streets, walks, grass, shrubbery and trees, which was caused by workmen or equipment employed during progress of work. All such repairs shall be made to satisfaction of the Owner's Representative, at no cost to the Owner, or reimburse the Owner if the Owner elects to make repairs. For landscape damage, the Owner shall make such repairs. Compensation for these repairs shall be determined by the Owner's Representative using the "Valuation of Landscape Trees, Shrubs, and other Plants" as published by the International Society of Arboriculture, as last revised.

b. Construction Project Fencing:

(1) Fencing requirements, as indicated on Drawings, shall be constructed of 9 or 11-gauge chain link not less than six (6) feet in height and not more than 2-inch mesh with posts spaced not more than ten (10) feet apart and all corner and gate posts imbedded in concrete. All other posts shall be sufficiently secured in ground to maintain proper and adequate support of fence. Fenced in area shall have at least two (2) access gates and all gates shall be lockable.
(2) Fence screening fabric shall be used on all perimeter fencing. Fabric shall be black in color, full height of the project fence, securely attached and properly maintained throughout the duration of the project.

(3) Using existing landmarks, lamp posts, trees or other Owner property for support of fencing is strictly prohibited unless a written waiver is obtained from Owner's Representative.

(4) Use of ribbon, snow fence, chicken wire, rope, and wooden barricades as fencing is prohibited.

(5) Fencing shall be maintained in an "as-installed" condition throughout the life of the project.

(6) The Contractor may use used fencing provided it is in good condition and is satisfactory to the Owner's Representative.

c. Preserving and Protecting Existing Vegetation:

(1) Protection and compensation for damages:

(a) Trees and shrubs within work area designated to remain shall be protected from damage during construction by fencing or armoring as indicated on Drawings or specified herein. Plant protection devices shall be installed before work has begun and shall be maintained for duration of work unless otherwise directed by Owner's Representative.

(2) Plants within work area designated for removal shall be removed by Contractor.

(3) To prevent compaction of soil over tree roots, vehicles or equipment shall not at any time park or travel over, nor shall any materials be stored within drip line of trees designated to remain.

(4) Owner's Representative will stop work immediately when proper measures are not being employed to protect trees and shrubs. Contractor will be notified to resume work after required protection measures are implemented.

(5) Pruning of limbs necessary to repair damage or provide clearance for work shall be done by the MU Landscape Services Department at the direction of the Owner's Representative. Limbs shall be cut off cleanly and cut surfaces treated according to established horticultural standards.
d. Hot Work Permitting:

(1) Hot work Requirements – The contractor shall comply with the following hot work requirements and the requirements of NFPA 51B.

(a) Hot work shall be defined as any work involving burning, welding, grinding, cutting, or similar operation that is capable of initiating fires or explosions.

(b) A Hot Work Permit shall be used on all hot work outside a designated hot work area. This permit shall be clearly visible within proximity of the hot work. The permit authorizing individual(s) shall be as designated by the Contractor. These permits may be obtained from the Owner’s Representative.

(c) Notify the Owner’s Representative prior to starting hot work in buildings where fire alarm / fire suppression systems exist so Campus Maintenance can be notified.

(d) A copy of all completed hot work permits shall be provided to the Owner’s Representative.

10. SUBSTITUTIONS and EQUALS

a. Substitutions are defined in General Conditions article 3.11.8 for and Equals are defined General Conditions Article 3.12.

b. Use of materials, products or equipment other than those named and described in the Contract Documents are substitutions and/or equal. Substitutions and/or equals submitted during the bidding period shall be received by both the Architect and the Owner at least ten calendar days prior to the date for receipt of bids. To be considered, bidder’s proposal shall include a complete description of the proposed substitution and/or equal and a comparison of significant qualities of the proposed substitution and/or equal with those specified including drawings, performance and test data, and other information necessary for an evaluation. The Architect's decision on the approval or disapproval of a proposed substitution and/or equal shall be final.

c. If the Architect and Owner approve a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approval made in any other manner.

d. No substitutions and/or equal will be allowed for the following items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification Section</th>
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<tbody>
<tr>
<td>33633</td>
<td>Swirl Meter</td>
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</table>
11. CODES AND STANDARDS

The Contractor shall comply with applicable codes and standards as listed in General Conditions. The following codes and standards shall also apply:

a. City of Columbia - Sewer Line Installation Standards - Department of Public Works

“All sanitary sewer construction shall be in accordance with the City of Columbia Specifications and Standards and in conformance with the rules and regulations of the Missouri Clean Water Commission.”

12. PERMITS

a. The Owner’s Representative shall secure University Authority Having Jurisdiction building permits required for the project and shall provide a list of required inspections to the Contractor. The Contractor shall work with the Owner’s Representative to coordinate and provide reasonable scheduling and access to the Work for the Owner’s inspection.

The permit applications are available at: www.dfs.dps.mo.gov/programs/bpv/.

13. SPECIALTIES

a. Owner furnished topsoil: The Owner will place the topsoil and provide final grade. The contractor shall rough grade to the following specification:

(1) The sub-grade is to be left at minus six inches (6”) in all areas unless indicated otherwise. All planting bed sub-grades are to be left a minus eighteen inches (18”). The contractor is to remove all deleterious material from the sub-grade prior to placing topsoil. All subgrade areas shall contain at least 6” of subsoil, (ie. cover clean rock backfilled areas). All subgrade areas shall be “ripped” a minimum of 6” deep and a maximum of 12” apart in opposite directions with minimal tire traffic to follow. All exposed deleterious material and unacceptable rock shall be removed.

(2) The contractor shall adjust all yard boxes valve boxes, pull boxes, cleanouts, and manhole lid rings etc. (includes irrigation, sewers, water and electric), to the indicated finish grade.

(3) Final plantings will be by the Owner. The Owner will water and maintain all seed, sod and landscaping.

14. PRE-BID INSPECTION

a. All pre-bid inspections of work areas shall be scheduled with pre-bid inspection guide, telephone: (573) 882-2228
15. MODIFICATION TO INFORMATION FOR BIDDERS

a. Information to Bidders:
   
   (1) Referenced Information to Bidders, Page IFB/6.

   Add new Article 15.9.2 as follows:

   **15.9.2.1** Within 48 hours of the receipt of bids, the apparent low bidder shall submit to the Director of Facilities Planning and Development an “Affidavit of Supplier Diversity Participation” for every diverse subcontractor or supplier the bidder intends to award work to on the contract. The affidavit will be signed by both the bidder and the diverse firm.

16. MODIFICATIONS TO GENERAL CONDITIONS

a. General Conditions:

   (1) Add to the Insurance Requirements in General Conditions Article 11, Asbestos Liability Coverage, for specified asbestos abatement in the contract documents, in a limit no less than $1,000,000 combined single limit, per occurrence and aggregate, for both bodily injury and property damage combined. The Owner will accept coverage from the Asbestos Removal Subcontractor in lieu of the General Contractor subject to all requirements set forth in article 11.

17. PROJECT SCHEDULING

a. The project scheduling specification for the project are included immediately after the Special Conditions. For this project the Contractor shall meet the following scheduling requirements.

   (1) Option #1 - Contractor Schedule (Small Projects only): Contractor is responsible for the schedule and must comply with the Owner's requirements. See Contractor Schedule Specification included in these documents.

18. PROJECT COORDINATION

a. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

   (1) Schedule construction operations in the 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.
(2) Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

(3) Make provisions to accommodate items scheduled for later installation.

19. BUILDING SYSTEM COMMISSIONING

a. Contractor shall provide all personnel and equipment required to complete the commissioning activities referenced in the Commissioning Plan. The requirements of the commissioning plan shall be completed in their entirety before substantial completion and submitted as referenced in the Closeout Log.

b. The contractor shall designate a competent person, separate from the superintendent or project manager, to act as the contractor’s commissioning coordinator. The commissioning coordinator is responsible for planning, scheduling, coordinating, conducting and verifying all commissioning activities required by the commissioning plan and ensuring all building systems are complete, operable and ready for use by the Owner. At a minimum, building ventilation systems, chilled/hot water generation systems, hydronic distribution systems, power distributions systems and fire detection and alarm systems, as applicable.

20. SAFETY PRECAUTIONS AND PROGRAMS

a. The contractor shall provide Emergency Contact Information for the Contractor’s on-site staff and home office management as well as contact information for all major subcontractor personnel. This information shall contain business and personal phone numbers for each individual for contact during or after hours in case of an emergency. This information shall be submitted within 15 days of the Notice to Proceed.

21. GENDER NEUTRAL SIGNAGE

a. All contractor installed signs including signs referenced in General Conditions articles 3.5.3 and 10.2.3 shall be gender neutral in wording.

22. CONSTRUCTION WASTE MANAGEMENT

a. The goal of Construction Waste Management is to divert construction waste from the sanitary landfill. This shall be accomplished through reuse, recycling and/or salvage of non-hazardous construction and demolition debris to the greatest extent practical. Track and report all efforts related to reuse, recycling and/or salvage of materials from the project (including clean fill material). Report all material types and weights, where material was diverted, type of diversion, documentation (e.g.: waste tickets) of this diversion, and applicable dates. In order to calculate the diversion
percentage, total weights of all landfill material (non-hazardous) must also be reported.

This information shall be updated monthly with final submission prior to project substantial Completion. Copies of all applicable receipts, tickets and tracking logs shall be uploaded to the Owner’s information sharing website or reported as required by the project manager. Tracking logs shall be reported in tabular form utilizing the MU Construction Waste Management Worksheet (http://www.cf.missouri.edu/cf/pdc/contractor_information).

23. WARRANTY WALKTHROUGH

a. Contractor shall attend a walk-thru with the Owner at 11 months after acceptance to review and document any warranty items to be addressed as part of the 12 month warranty stated in article 3.1 of the General Conditions.

END OF SECTION
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SECTION 1.E.1

SCHEDULING SPECIFICATION

Option #1

1. GENERAL

   a. Time is of the essence for this contract. The time frames spelled out in this contract are essential to the success of this project. The University understands that effective schedule management, in accordance with the General Conditions and these Special Conditions is necessary to insure that the critical milestone and end dates spelled out in the contract are achieved.

   b. Related Documents
      Drawings and general provisions of the Contract, including General Conditions’ Article 3.17 shall apply to this Section.

   c. Stakeholders
      A Stakeholder is anyone with a stake in the outcome of the Project, including the University, the University Department utilizing the facility, the Design Professionals, the Contractor and subcontractors.

   d. Weather

      (1) Contractor acknowledges that there will be days in which work cannot be completed due to the weather, and that a certain number of these lost days are to be expected under normal weather conditions in Missouri.

      (2) Rather than speculate as to what comprises “normal” weather at the location of the project, Contractor agrees that it will assume a total of 44 lost days due to weather over the course of a calendar year, and include same in its as planned schedule. For projects of less than a calendar year, lost weather days should be prorated for the months of construction in accordance with the following schedule.

      (3) Anticipated weather days for allocation/proration only. For projects lasting 12 months or longer, the 44 days per year plus whatever additional months are included will constitute normal weather.

<table>
<thead>
<tr>
<th>Jan – 5 days</th>
<th>Feb – 5 days</th>
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<td>Sep – 3 days</td>
<td>Oct – 4 days</td>
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</tbody>
</table>

2. SCHEDULING PROCESS
a. The intent of this section is to insure that a well-conceived plan, that addresses the milestone and completion dates spelled out in these documents, is developed with input from all stakeholders in the project. Input is limited to all reasonable requests that are consistent with the requirements of the contract documents, and do not prejudice the Contractor’s ability to perform its work consistent with the contract documents. Further, the plan must be documented in an understandable format that allows for each stakeholder in the project to understand the plan for the construction and/or renovation contained in the Project.

b. Contractor Requirements

(1) Schedule Development
Contractor shall prepare the Project Schedule using Primavera SureTrack or P3, Microsoft Project, Oracle P6, or other standard industry scheduling software, approved by the Owner’s Representative.

(2) Schedule Development
Within 2 weeks of the NTP, contractor shall prepare a schedule, preferably in CPM format, but in detailed bar chart format at a minimum, that reflects the contractor’s and each subcontractor’s plan for performing the contract work.

Contractor shall review each major subcontractor’s schedule with the sub and obtain the subcontractor’s concurrence with the schedule, prior to submitting to the University.

(3) Schedule Updates

(a) Schedule Updates will be conducted once a month, at a minimum. Actual Start and Finish dates should be recorded regularly during the month. Percent Complete, or Remaining Duration shall be updated as of the data date, just prior to Contractor’s submittal of the update data.

(b) Contractor will copy the previous months schedule and will input update information into the new monthly update version.

(c) Contractor will meet with the Owner’s Representative to review the draft of the updated schedule. At this meeting, Owner’s Representative and Contractor will:
   (i) Review out of sequence progress, making adjustments as necessary
   (ii) Add any fragnets necessary to describe changes or other impacts to the project schedule
(iii) Review the resultant critical and near critical paths to determine any impact of the occurrences encountered over the last month.

(4) Schedule Narrative

After finalization of the update, the Contractor will prepare a Narrative that describes progress for the month, impacts to the schedule and an assessment as to the Contractor’s entitlement to a time extension for occurrences beyond its control during the month and submit in accordance with this Section.

(5) Progress Meetings

(a) Review the updated schedule at each monthly progress meeting. Payments to the Contractor may be suspended if the progress schedule is not adequately updated to reflect actual conditions.

(b) Submit progress schedules to subcontractors to permit coordinating their progress schedules to the general construction work. Include 4 week look ahead schedules to allow subs to focus on critical upcoming work.

3. CRITICAL PATH METHOD (CPM)

a. This Section includes administrative and procedural requirements for the critical path method (CPM) of scheduling and reporting progress of the Work.

b. Refer to the General and Special Conditions and the Agreement for definitions and specific dates of Contract Time.

c. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the Project.

d. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall project duration.

e. Network Diagram: A graphic diagram of a network schedule, showing the activities and activity relationships.

f. 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.

g. Critical activities are activities on the critical path.

h. Predecessor activity is an activity that must be completed before a given activity can be started.
i. Milestone: A key or critical point in time for reference or measurement.

j. Float or Slack Time: The measure of leeway in activity performance.

k. Accumulative float time is not for the exclusive use or benefit of the Owner or Contractor, but is a project resource available to both parties as needed to meet contract milestones and the completion date.

l. Total float is herein defined as the measure of leeway in starting or completing an activity without adversely affecting the planned project completion date.

m. Weather: Adverse weather that is normal for the area must be taken into account in the Contractor’s Project Schedule. See 1.d.3, above.

n. Force Majeure Event: Any event that delays the project but is beyond the control and/or contractual responsibility of either party.

o. Schedule shall including the following, in addition to Contractor’s work.

1. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
   a. Requirements for phased completion and milestone dates.
   b. Work by separate contractors.
   c. Work by the Owner.
   d. Coordination with existing construction.
   e. Limitations of continued occupancies.
   f. Uninterruptible services.
   g. Partial occupancy prior to Substantial Completion.

p. Area Separations: Use Activity Codes to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

4. TIME EXTENSION REQUEST

a. Refer to General Conditions of the Contract for Construction, Article 4.7 Claims for Additional Time.

b. Changes or Other Impacts to the Contractor’s Work Plan
   The Owner will consider and evaluate requests for time extensions due to changes or other events beyond the control of the Contractor on a monthly basis only, with the submission of the Contractor’s updated schedule, in conjunction with the monthly application for payment. The Update must include:

   1. An activity depicting the event(s) impacting the Contractors work plan shall be added to the CPM schedule, using the actual start
date of the impact, along with actually required predecessors and successors.

(2) After the addition of the impact activity, the Contractor will identify subsequent activities on the critical path, with finish to start relationships that can be realistically adjusted to overlap using good, standard construction practice.
(a) If the adjustments above result in the completion date being brought back within the contract time period, no adjustment will be made in the contract time.
(b) If the adjustments above still result in a completion date beyond the contract completion date, the delay shall be deemed excusable and the contract completion date shall be extended by the number of days indicated by the analysis.
(c) Contractor agrees to continue to utilize its best efforts to make up the time caused by the delays. However the Contractor is not expected to expend costs not contemplated in its contract, in making those efforts.

c. Questions of compensability of any delays shall be held until the actual completion of the project. If the actual substantial completion date of the project based on excusable delays, excluding weather delays, exceeds the original contract completion date, AND there are no delays that are the responsibility of the contractor to consider, the delays days shall be considered compensable. The actual costs, if any, of the Contractor’s time sensitive jobsite supervision and general conditions costs, shall be quantified and a change order issued for these costs.

END SECTION
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Project: Loeb Hall – Building Demolition  
Project Number: CP181011  
Contractor:  

### SECTION 1.E.2

**SHOP DRAWING AND SUBMITTAL LOG**

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# SECTION 1.E.2

## SHOP DRAWING AND SUBMITTAL LOG

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**Project Number:** CP181011  
**Contractor:**

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**SECTION 1.E.3**

**OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG**

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**Project Number:** CP181011  
**Contractor:**

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## SECTION 1.E.4

### CLOSEOUT LOG

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**CLOS - 1**
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| Commissioning Agent - Conduct pre-installation meetings per specifications. | | | | | Meeting Minutes

| 2 Waterproofing | | | | | |
| Contact Owner's Representative prior to backfilling to allow for inspection of damp/waterproofing. | | | | | Inspection Report

| 3 Sump Pumps | | | | | |
| Test for proper operation including float valve limits | | | | | Startup Report

| 4 General Duty Valves | | | | | |
| Verify proper valve operators and stems are installed | | | | | |

| 5 Pneumatic Tubing | | | | | |
| Provide air pressure test. 1.5 times operation pressure for 24 hours | | | | | Pressure test certification

| 6 Steam and Condensate piping. | | | | | |
| Pressure test piping at 150 PSI | | | | | Test Report

1/2/2020
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Please see following website for suggested commissioning forms:

https://www.cf.missouri.edu/cf/pdc/commissioning-forms
Water – turned on to the first valve past Energy Management’s last valve.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Insulation installed (preferred but not required).
- Meter properly installed, working, and in readable location.
- Contractor has swabbed out with chlorine all piping from the backflow preventer to the source while installing.
- All bacteriological tests have been completed and passed.
- Backflow preventer installed and tested. (will need water pressure to test)
- Pressure test completed in piping being turned on.
- Contractor has method to communicate “Services On” to other contractor personnel and Owner’s personnel.
- Consultant has signed off

Steam – turned on to the first valve past Energy Management’s last valve.

- Review all piping, equipment, valves, reducing stations, relief valves, etc. for proper installation and complete testing.
- Piping protected from the weather.
- Insulation must be installed.
- All hangers and bolts have been installed.
- Meter installed, working and in readable location. (Don’t need metasys to turn on.)
- All needed traps are installed and able to be tested as they are turned on.
- Condensate system is installed and operating including the pumping system.
- Pressure test completed in piping being turned on.
- Contractor has method to communicate “Services On” to other contractor personnel and Owner’s personnel.
- Consultant has signed off

Condensate – turned on to the first valve past Energy Management’s last valve.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Piping protected from the weather.
- Insulation installed (preferred but not required).
- Pressure test completed in piping being turned on.
- Contractor has method to communicate “Services On” to other contractor personnel and Owner’s personnel.
- Consultant has signed off

Electric – turned on to the first breaker past 13.8kV transformer.

- Review all wiring and equipment being turned on for proper installation and completed testing.
- GFCI set and tested.
- Breakers set and tested.
- All needed permanent grounds are installed.
- Meter installed, working and in readable location.
- Main switchgear protected from the weather.
- Contractor has method to communicate “Services On” to other contractor personnel and Owner’s personnel.
- Consultant has signed off

Chilled Water – turned on to the first valve inside of building.

- Review all piping and equipment being turned on for proper installation and completed testing.
- Insulation must be installed.
- Meter installed, working and connected to Metasys.
- Building pump and automatic isolation/control valve must be installed and under control.
- Chillers are installed, automatic loop pump isolation must be installed.
- Control valves must be installed and automatically controlled on all loads.
- Contractor has method to communicate “Services On” to other contractor personnel and Owner’s personnel.
- Consultant has signed off
SECTION 1.F
INDEX OF DRAWINGS


Drawing Sheet G100 Cover Sheet
Drawing Sheet CE1 Existing Site Plan
Drawing Sheet CE2 Demolition Plan
Drawing Sheet CE3 Site and Grading Plan
Drawing Sheet CE4 Site Details
Drawing Sheet TC1 Temporary Traffic Control Plan
Drawing Sheet S100 Steam Manhole #049 Plan and Details
Drawing Sheet S101 Steam Manhole #049 Concrete Repairs
Drawing Sheet M000 Mechanical Symbols and Abbreviations
Drawing Sheet M100 Mechanical Site Plans
Drawing Sheet M101 Loeb Hall Mechanical Plans
Drawing Sheet M102 McReynolds Hall and McDavid Hall Mechanical Plans
Drawing Sheet M103 Mechanical Details
Drawing Sheet M200 Steam Expansion Schematic and Details
Drawing Sheet M201 Steam Utility Details
Drawing Sheet M202 Steam Utility Details
Drawing Sheet M203 Steam Utility Details
Drawing Sheet E100 Electrical Site Plans

END OF SECTION
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SECTION 1.G

PREVAILING WAGE RATES

1. The prevailing wage rates for Boone County as issued by the Missouri Division of Labor on the following pages.

END OF SECTION
Annual Wage Order No. 26

Section 010
BOONE COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by:
Taylor Burks, Director
Division of Labor Standards

Filed With Secretary of State: March 8, 2019

Last Date Objections May Be Filed: April 8, 2019

Prepared by Missouri Department of Labor and Industrial Relations
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*The Division of Labor Standards received less than 1,000 reportable hours as required by RSMo 290.257.4(b). Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center, in accordance with RSMo 290.257.2.

**Annual Incremental Increase
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</table>

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received less than 1,000 reportable hours as required by RSMo 290.257.4(b). Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center, in accordance with RSMo 290.257.2.
TECHNICAL SPECIFICATIONS - UNIVERSAL/HAZARDOUS MATERIALS REMOVAL AND DISPOSAL

For

UNIVERSITY OF MISSOURI
LOEB HALL (BLDG. C37-124)
PROJECT CP181011

Prepared for

UNIVERSITY OF MISSOURI
Campus Facilities
Columbia, Missouri 65211

Prepared by
UNIVERSITY OF MISSOURI
ENVIRONMENTAL HEALTH AND SAFETY
PART 1 - GENERAL

Provisions of the General Conditions and Special Conditions are part of this Division.

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 The Contractor shall inform him/herself of the conditions for the project, and is responsible for verifying the quantities and location of all work to be performed as outlined in this section. Failure to do so shall not relieve the Contractor of his obligation to furnish all materials and labor necessary to carry out the provisions of the Contract. The work of the Contract can be summarized as follows:

The work consists of the proper removal of the following approximate quantities of hazardous materials from Loeb Hall.

Demolition/Construction Waste

Hazardous Waste

Twenty eight (28) door closers
Nine (9) thermostats

Universal Waste

One hundred thirty six (136) four foot fluorescent light fixtures with their bulbs
One smoke detector
Eighteen (18) exit signs
Thirteen (13) emergency strobe lights
One high energy exterior light, west entry

Reclaim/Recycle

Three (3) drinking fountains

Building Materials Painted with Regulated Heavy Metals

One door/door frame and metal handrail are painted with lead-based paint

Radioactive Lab History/Activity

N/A

Loeb Hall Demolition

020810-1
1.2 CODES AND REGULATIONS:

1.1.2.1 All applicable codes, regulations, standards, statutes, laws, and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. Where conflicts arise, the most stringent specification shall apply.

1.1.2.2 Federal and State requirements which govern universal and hazardous removal work or hauling and disposal of such waste materials include but are not limited to the following:

   1.1.2.2.1.1 Construction Industry - 29 CFR 1926.1101
   1.1.2.2.1.2 Respiratory Protection – 29 CFR 1910.134
   1.1.2.2.1.3 Hazard Communication – 29 CFR 1910.1200
   1.1.2.2.1.4 Accident Prevention Signs – 29 CFR 1910.145

1.1.2.2.2 U.S. Environmental Protection Agency (EPA)

1.1.3 CONTRACTOR'S DUTIES

1.1.3.1 Except as specifically noted, provide and pay for:
   - Labor, materials, and equipment.
   - Tools, construction equipment, and machinery.
   - Other facilities and services necessary for proper execution and completion of work.

1.1.3.2 Pay legally required sales, consumer, use, payroll, privilege and other taxes. Retail sales tax shall not be included in the bid amount.

1.1.3.3 Secure and pay for, as necessary for proper execution and completion of work, and as applicable at the time of bids:
   - Permits
   - Government Fees
   - Licenses
   - Except where specifically noted, provide and pay for waste disposal permits and costs

1.1.3.4 Give required notices.

1.1.3.5 Contractor shall assume full responsibility and liability for compliance with all codes, ordinances, rules, regulations, orders and other legal requirements of Local, State, and Federal public authorities including Environmental Protection Agency (EPA) regulations, Missouri Department of Natural Resources (MDNR) and Occupational Safety
and Health Administration (OSHA) which bear on performance work. Where conflicts occur between these specifications and/or the above-mentioned regulations, the more stringent shall govern. The Contractor shall hold the owner and owner’s air monitoring firm harmless for failure to comply with any applicable work, hauling, safety, health, or other regulations on the part of the contractor, contractor’s employees, or contractor’s subcontractors.

1.1.3.6 If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify MU in writing, and any necessary changes shall be accomplished by appropriate modification. It is not the Contractor’s responsibility to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to MU, he shall assume full responsibility therefore and shall bear all cost attributable thereto.

1.1.3.7 Enforce strict discipline and good order among employees. Do not employ unfit persons or persons not skilled in assigned task.

1.1.3.8 Comply with all applicable federal, state, and local laws regarding job discrimination and payment of prevailing wage rates for the base bid.

1.1.3.9 The use of the best available technology, procedures, and methods for preparation, execution, cleanup, disposal, and safety are absolutely required. This compliance is the sole responsibility of the abatement contractor.

1.1.3.10 Assume responsibility for the proper and safe execution of the work.

1.1.8 COORDINATION: The hazard remediation contractor shall be responsible for the coordination of the universal/hazardous materials removal for this project. The hazard remediation contractor shall coordinate with all other on-site contractors and all subcontractors working under separate contracts so as to facilitate the general progress of the work. Each trade shall afford all trades every reasonable opportunity for the installation of their work.

1.2 STOP WORK

1.2.1 If the Owner, or his designated representative, presents a written or verbal stop work order, immediately stop all work or that portion of the work designated. A verbal stop work order shall be confirmed by a written stop work order within 24 hours. Do not commence referenced work until authorized in writing by the Owner or his representative.

1.3 CONTRACTOR USE OF PREMISES

1.3.1 GENERAL: During the construction period for each building, the hazard remediation contractor will have full access to Loeb Hall for construction
operations. Owner will keep the elevators operational.

1.3.2 USE OF THE SITE: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

1.3.2.1 Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Contractor will be allowed to use the parking lot to the north of the building for parking and/or storage of materials.

1.3.2.2 Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to areas acceptable to Owner. If additional storage is necessary, obtain and pay for such storage off-site.

1.3.2.3 Do not load structure with weight that will endanger structure.

1.3.2.4 Assume full responsibility for protection and safekeeping of products stored on premises.

1.3.2.5 Move any stored products which interfere with operations of Owner or other contractors.

1.3.2.6 Contractor personnel shall utilize only those entrances/exits and parking lots designated by the Owner.

1.3.2.7 Contractor shall utilize only those areas designated by the Owner for the storage of equipment and the placement of dumpsters/transport containers.

1.3.2.8 Take all cautions necessary to ensure there is no universal and hazardous material contamination to those areas not included in work schedule. Should areas outside the work area become contaminated with hazardous materials, the Contractor shall immediately clean them utilizing the wet cleaning and HEPA vacuum methods specified herein. The hazard remediation contractor is responsible for the proper cleanup of all items in the work areas to maintain a clean and safe environment.

1.3.3 CONTRACTOR'S USE OF THE EXISTING BUILDING: Maintain the existing building in a safe and weather tight condition throughout the construction period. Take all precautions necessary to protect the building and its occupants during the construction period.

1.3.3.1 Keep areas such as walkways and stairs free from accumulation of waste material, rubbish or construction debris.

1.3.3.2 Smoking or open fires are prohibited within the building or on the premises.

1.4 OWNER OCCUPANCY
1.4.1 **PARTIAL OWNER OCCUPANCY**: The Owner reserves the right to occupy areas of the building in which universal/hazardous waste removal has been completed, provided that such occupancy does not substantially interfere with completion of the work. The Owner also reserves the right to occupy portions of the building not involved in this Scope of Work. Such partial occupancy shall not constitute acceptance of the work or any part of the work. The Owner shall also maintain the right to access areas where no universal and hazardous waste work is being performed.

2.1 **SUBMITTAL REQUIREMENTS**

2.1.1 The following will be submitted by the contractor prior to commencement of work for approval by Owner’s Certified Industrial Hygienist (one copy for the Owner’s Representative). The Owner’s C.I.H. will return reviewed copies to contractor and Owner’s Representative.

2.1.1.1 One copy of any Safety Data Sheets (SDS) for products to be used by the contractor in the performance of his work. Contractor will also maintain copies of SDS on site per OSHA.

2.1.2 Submit the following for all Supervisor(s) and Workers who will be on the project site prior to commencement of work:

2.1.2.1 A list of project personnel and contact phone numbers

2.1.2.2 Current training certificates, if applicable

2.1.2.3 Physician’s Statement that each person is physically fit to wear a respirator, if respirator use is required

2.1.2.4 Respirator Fit Test, if respirator use is required

2.1.3 Submit a detailed plan of the procedures proposed for use in complying with requirements of this specification. Include in the plan the layout and location of work areas, route of ingress and egress for the work areas, methods used to assure safety of building occupants and visitors, method of removal of material, and disposal container requirements for lead based paint material to be disposed.

2.1.4 Proposed disposal site for lead-based paint materials, including a disposal plan to detail type of disposal container, method of transportation to disposal site, and waste hauler.

2.1.5 Any other submittals as required by MU.

2.1.6 Upon completion of the universal/hazardous material removal, submit to the Owner’s Representative, copies of hazardous materials shipping records, disposal receipts, incineration documentation, etc. for all hazardous materials removed from the project site.

2.1.7 Upon completion of the universal waste/hazardous material removal, the following information shall be submitted by the Owner’s C.I.H. to the contractor:

2.1.7.1 Construction and demolition waste landfill receipts, disposal receipts, truck tickets, incineration/recycling receipts and documentation.
2.1.7.2 Written visual certification from the Owner’s Certified Industrial Hygienist that universal waste/hazardous material have been removed from the facility.

2.2 TERMINOLOGY (Definitions)

2.2.1 APPROVED Construction and Demolition WASTE DISPOSAL SITE: A permitted solid waste landfill that is authorized by the Missouri Department of Natural Resources to receive construction and demolition wastes.

2.2.2 AUTHORIZED VISITOR: The Building Owner, the Building Owner’s representative, MU personnel, or a representative of any regulatory or other agency having jurisdiction over the project.

2.2.3 BARRIER: Any surface that seals off the work area to non-authorized personnel from entering the work area.

2.2.4 BUILDING OWNER: A representative of the University of Missouri.

2.2.5 DISPOSAL CONTAINER: A properly labeled container for universal/hazardous materials. The proposed disposal container for lead-based paint will be provided to the Owner’s Representative and part of the hazard remediation contractor’s pre-work.

2.2.6 HEPA VACUUM EQUIPMENT: High efficiency particulate air filtered vacuuming equipment with a filter system capable of collecting and retaining hazardous particulates. Filters should be of 99.97% efficiency for retaining particulates greater than 0.3 microns.

2.2.7 ON-SITE REPRESENTATIVE: MU’s full-time representative responsible for air monitoring and enforcement of the specifications.

2.2.8 OWNER’S CERTIFIED INDUSTRIAL HYGIENIST (C.I.H.): An Industrial Hygienist, certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH).

2.2.9 HAZARDOUS MATERIAL SHIPMENT RECORD/DISPOSAL RECEIPT: The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of universal/hazardous materials.

2.2.10 WET CLEANING/WIPING: The process of eliminating contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as necessary.

2.2.11 WORK AREA: A specific isolated area in which universal/hazardous waste materials are required to be handled. The area is designated as a work area from the time that the area is secured and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

2.3 EXISTING CONDITIONS

Loeb Hall Demolition

020810-6
2.3.1 Building Owner and Contractor shall agree on building conditions prior to commencement of work. It shall be the Contractor's responsibility to replace or repair to the Owner's satisfaction, prior to close-out of the project, all damaged items caused by the Contractor and not proven otherwise. All items damaged prior to remediation shall be noted during preconstruction walk-through.

3.1 PERSONNEL PROTECTION REQUIREMENTS

3.1.1 Prior to commencement of work, the workers shall be instructed and shall be knowledgeable on the hazards of the universal hazardous materials involved and other environmental exposures, use and fitting of respirators, protective clothing, decontamination procedures, and all aspects of remediation work procedures; workers shall have medical examinations.

3.1.2 The Contractor acknowledges that he alone is responsible for enforcing personnel protection requirements and that these specifications provide only a minimum acceptable standard for each phase of operation.

3.1.3 If required or requested of the workers, provide workers with personally issued and marked respiratory equipment approved by NIOSH and accepted by OSHA.

3.1.4 No visitors shall be allowed in work areas, except as authorized.

3.1.5 Where required or if requested by the workers, provide workers with sufficient sets of disposable protective full-body clothing. Such clothing shall consist of full-body coveralls, footwear, and head gear, one-piece coveralls or equal. Provide eye protection and hard hats as required by applicable safety regulations. Disposable clothing shall not be allowed to accumulate and shall be disposed of as contaminated waste.

3.1.6 Provide authorized visitors with suitable protective clothing, headgear, footwear, and gloves as described above whenever they are required to enter the work area.

3.2 MATERIALS

3.2.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

3.2.1.1 Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

3.2.1.2 Damaged or deteriorating materials shall not be used and shall be removed from the premises.

3.2.2 PLASTIC SHEETING: A minimum 6-mil (or as specified).

3.2.3 TAPE: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water, duct tape, poly prep tapes or approved equal.
3.2.4 **ADHESIVES**: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

3.2.5 **IMPERMEABLE CONTAINERS**: Suitable to receive and retain any hazardous materials until disposal by the owners rep. The containers shall be labeled as required by owner. Containers must be resistant to damage and rupture.

3.2.6 **WARNING LABELS AND SIGNS**: As required by owner.

3.2.7 **OTHER MATERIALS**: Provide all other materials, such as, but not limited to lumber, plywood, nails, and hardware, which may be required to properly prepare and complete this project.

### 3.3 TOOLS AND EQUIPMENT

3.3.1 Provide suitable tools for universal/hazardous waste removal and disposal.

3.3.1.1 **Water Sprayer**: Airless or a low pressure sprayer for amended water application as applicable.

3.3.1.2 **Air-Purifying Equipment**: High Efficiency Particulate Air Filtration Systems (HEPA) shall comply with ANSI Z9.2-91. No air movement system or air equipment should discharge particulates outside the work area. Thus, the negative air unit shall be equipped with a three filter bank with the last being the HEPA filter capable of removing 99.97% of fibers/particulates >0.3 microns.

3.3.1.3 **Scaffolding**: As required to accomplish the specified work and meet all applicable safety regulations.

3.3.1.4 **Vacuums**: Use HEPA type from a known manufacturer.

3.3.1.5 Other tools and equipment as necessary.

### 3.4 SUPERVISION OF UNIVERSAL/HAZARDOUS Material REMOVAL

3.4.1 The contractor shall designate a competent supervisor subject to the approval of the Owner’s C.I.H. and the Owner’s Representative. The supervisor shall be the Contractor’s representative on the project, shall meet the requirements of all applicable regulations, and perform or meet the following minimum requirements:

3.4.1.1 Be knowledgeable in all aspects of removal, cleanup and proper disposal of universal hazardous materials as listed in the Scope of Work.

3.4.1.2 Be onsite and supervise all removal, cleanup and disposal activities.

3.4.1.3 Maintain a daily log on the project documenting events, violations, problems, equipment failures, accidents, and inspections.

3.4.1.4 Be responsible for implementation of first aid, safety training, respiratory protection, and ensuring all workers are trained in emergency
procedures.

3.4.1.5 Be responsible for conducting a visual inspection of the work area prior to a visual inspection by the Owner’s Certified Industrial Hygienist. Inspection shall be documented.

3.5 WORKER PROTECTION / TRAINING

3.5.1 The contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, maintaining medical records, protective clothing and equipment to comply with OSHA requirements, if necessary.

3.5.2 All workers shall be trained in the dangers inherent in handling universal waste, and hazardous materials, in proper work procedures, and personal protective measures.

3.6 OWNER’S CERTIFIED INDUSTRIAL HYGIENIST

3.6.1 It will be the Owner’s responsibility to hire a Certified Industrial Hygienist. The Certified Industrial Hygienist will also be required to perform the following duties as a minimum:

3.6.1.1 Approval of the Contractor’s work plan and methods of remediation to meet regulatory requirements and ensure the health and safety of University faculty, staff, and students.

3.6.1.2 Verify that the Contractor is satisfactorily performing the work in accordance with OSHA regulations.

3.6.1.3 Visual inspection of the work areas.

3.6.1.4 Certify in writing that the Contractor’s procedures, methods, and practices were, to the best of his/her knowledge and belief, in compliance with current EPA, OSHA, State, and Local applicable regulations, that the work areas meet the requirements for a final visual inspection prior to re-occupancy, and an accounting of any known deviations.

3.7 SEPARATION OF WORK AREAS FROM NONWORK AREAS

3.7.1 Visual separation shall be accomplished at all "see-through" locations using opaque polyethylene. This separation shall not be incorporated within the other seals involved on this project.

3.8 EMERGENCY PROTECTION PLAN / FIRE EXITS

3.8.1 The contractor shall be responsible for developing a written Emergency Protection Plan and shall maintain this plan onsite. The plan shall include considerations of fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

3.8.2 The Emergency Protection Plan shall also include written notification of police,
fire, and medical personnel of the planned remediation activities, work schedule, and layout of the work area, particularly barriers that may affect response capabilities.

3.8.3 Designate and maintain emergency and fire exits from the work area in accordance with local codes and regulations. All exits shall be clearly marked with fluorescent tape or red paint and shall be clearly visible from any part of the work area.

3.9 LOCAL AREA PROTECTION / SITE SECURITY

3.9.1 The contractor shall secure the work areas to make sure of no inadvertent entry. Any breach to the exterior of the building shall be secured by the hazard remediation contractor. The Contractor shall be responsible for maintaining security of the remediation areas throughout the contract period.

3.9.2 The contractor shall be responsible for all areas of the building used by contractor and/or subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner.

3.9.3 Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations required of Contractor’s employees.

3.9.4 The contractor shall have control of site security during remediation operations in order to protect the work environment and equipment. Contractor shall have the owner’s assistance in notifying building occupants of impending activity and enforcement of restricted access by owner’s employees.

3.9.5 The contractor shall keep a minimum of two (2) 10lb type ABC fire extinguishers onsite. One shall be maintained outside the work area and one inside each work area. Contractor employees shall be trained in the operation of fire extinguishers.

3.9.6 The contractor shall maintain the work area free from rubbish, debris, and dirt, and keep a clean, safe working area.

3.10 UNIVERSAL WASTE/HAZARDOUS MATERIALS REMOVAL OPERATIONS

3.10.1 Any light fixtures, housings, etc. concealing items considered to be universal waste/hazardous material shall be removed, containerized, labelled, and left on site for disposal by MU EHS. This does not include refrigerant or CHC/HFRC-containing equipment which are being replaced by the contractor. It does not include TCLP ceramic tile, which should be handled by the contractor.

3.10.2 MATERIALS PAINTED WITH RCRA-Metals PAINT –
It is anticipated that these items will be removed as part of the demolition process and will be segregated from the remainder of the demolition debris.
It is anticipated that these items will be hauled away and disposed of in a sanitary landfill approved by the State of Missouri to accept construction and demolition waste. These areas should be sealed off with polyethylene sheeting over the doors, vents, windows, or any other openings into/out of the area.

3.10.3 **FLUORESCENT LIGHT TUBES** may contain small amounts of Mercury. This can potentially be harmful to human health and the environment. The bulbs should be placed in fiberboard boxes provided by MU EHS to minimize breakage. MU EHS will manage disposal of this material.

3.10.4 **POLYCHLORINATED BIPHENYL (PCBS)** are a known carcinogenic material. Its use was discontinued January 1, 1979. Due to the age of the building, it should be assumed that any ballast can contain PCBs unless it is labeled as PCB free by the manufacturer. Due to this, any light ballasts presumed to contain PCBs should be properly disposed of. MU Environmental Health Safety will provide collection container for this purpose. Non-PCB ballasts will also be managed by MU Environmental Health Safety. Collection containers will be provided to the contractor upon their request.

3.10.5 **SMOKE DETECTORS** are typically ionization smoke detectors that may contain a small amount of radioactive material. MU Environmental Health and Safety will provide collection containers for this material and will also be responsible for the disposal of this material.

3.10.6 **FIRE ALARMS (STROBE LIGHT)** are typically not considered a universal or hazardous waste. However, for the purposes of this project, these items should be collected by the contractor and managed by MU Environmental Health and Safety. Collection containers will be provided to the contractor upon their request.

3.10.7 **EXIT SIGNS AND EMERGENCY LIGHTS** typically have backup batteries that may contain small amounts of lead. Some exit signs are powered by a small amount of radioactive material. Powered exit signs and emergency lights should have the battery removed and disposed of by MU Environmental Health and Safety. Non powered exit signs should be assumed to contain radioactive material and should be collected for disposal via MU Environmental Health and Safety. MU Environmental Health and Safety will provide collection containers for these items.

3.10.8 **DRINKING FOUNTAINS**: Some drinking fountains have reservoirs that may contain lead and a CFC/HCFC refrigerant that must be recovered. The lead reservoirs should be removed and recycled. The CFC/HCFC refrigerant must be recovered by a contractor licensed and trained in this type of work. The remainder of the unit should be managed as scrap metal.
3.10.9 **DOOR CLOSURES**: Some of the older door closures have oil reservoirs for lubrication. These oils may contain small amounts of PCBs. MU Environmental Health and Safety will provide a collection container for this material, and will be responsible for disposal.

3.10.10 **THERMOSTATS** may contain Mercury. This can potentially be harmful to human health and the environment. Mercury containing thermostats shall be disposed of as a hazardous waste. MU EHS will provide a collection container for this material, and will be responsible for disposal.

3.10.11 **WINDOW AIR CONDITIONING UNITS**: Where possible, these window units should be removed and stored for use elsewhere. Otherwise these units may contain CFC/HCFC refrigerants that must be recovered. CFC/HCFC refrigerants are suspected to damage the atmosphere. The CFC/HCFC refrigerant must be recovered by a contractor licensed and trained in this type of work. The remainder of the unit should be managed as scrap metal.

3.10.12 **CERAMIC TILE**: are made from clay bodies that contain high concentrations of silica. Respirable crystalline silica is a “known human carcinogen.” When ceramic tiles are cut, abraded, shattered, or crushed, hazardous silica dust can be generated. Ceramic tiles can also have high concentrations of toxic metals, in the clay body and in the glazing, and potentially be classified as Hazardous Waste. The ceramic tiles will need to be collected, containerized by the contractor, and picked up by MU EHS.

3.12 **REESTABLISHMENT OF THE WORK AREA**

3.1-2.1 Reestablishment of the work area shall only occur after the Contractor has received a final visual inspection from the Owner's C.I.H. documenting that the universal/hazardous waste materials have been removed from the project site.

END OF SECTION
TECHNICAL SPECIFICATIONS - ASBESTOS-CONTAINING MATERIALS REMOVAL AND DISPOSAL

For

UNIVERSITY OF MISSOURI
LOEB HALL (BLDG. C37-124)
PROJECT CP181011

Prepared for

UNIVERSITY OF MISSOURI
Campus Facilities
Columbia, Missouri 65211

Prepared by

UNIVERSITY OF MISSOURI
ENVIRONMENTAL HEALTH AND SAFETY
PART 1 - GENERAL

Provisions of the General Conditions and Special Conditions are part of this Division.

1.1 SCOPE OF WORK

1. General: The work specified herein shall be the abatement of asbestos containing materials by certified and registered persons who are knowledgeable, qualified and trained in the abatement, handling, and disposal of asbestos containing material, and subsequent cleaning of the affected environment.

2. The Contractor shall furnish all labor, material, equipment, testing, services, permits, insurance, notifications, necessary or required to perform the work in accordance with applicable local, state, and federal regulations for the abatement of asbestos containing materials and for other work as specified in this section or as indicated in associated drawings, sketches, or reports of the work.

All fees required for notification requirements, renotations, and/or inspections by the regulatory agencies shall be paid by the Contractor. Bulk sample analysis information required by the Department of Natural Resources, U.S. Environmental Protection Agency or local authority having jurisdiction in conjunction with the notification shall also be provided by the Contractor unless provided within this section.

3. The work shall include the removal and legal disposal of friable and non-friable asbestos containing materials including

Friable asbestos:

Three hundred (300) linear feet of ACM pipe insulation-this includes pipe insulation in the sub-basement mechanical room of McReynolds Hall, which will be disturbed by the project.

It is likely that more ACM pipe insulation will be uncovered in the process of demolition of Loeb Hall. Unit pricing would be prudent.

Pipe insulation associated with utilities entering Loeb are presumed to be asbestos-containing. This material should also be bid at a unit price.

Non-friable asbestos:

One thousand six hundred ten (1610) square feet of ACM flooring system, consisting of floor tile, adhesive black mastic, and, potentially, floor leveler

Sixteen (16) linear feet of white ACM caulk

Eighteen (18) fire-rated doors
1.2 DEFINITIONS

1. Abatement - Procedures to decrease or eliminate the source of fiber release from asbestos containing building materials. Includes encapsulation, enclosure, and removal.

2. Adequately Wet - To sufficiently mix or penetrate with liquid to prevent the release of particulate.

3. Aggressive Air Sampling - Sweeping of floors, ceilings and walls and other surfaces with the exhaust of a minimum of one (1) horsepower leaf blower or equivalent immediately prior to air monitoring.

4. Approved Waste Disposal Site - A solid waste disposal area that is authorized by the Department of Natural Resources to receive asbestos containing solid wastes.

5. Asbestos - The asbestiform varieties of serpentine (chrysotile, antigorite), riebeckite (crocidolite), cummintonite-grunerite (amosite), anthophyllite, and actinolite-tremolite.

6. Asbestos Abatement Supervisor - An individual who directs, controls, or supervises others in asbestos abatement projects.

7. Asbestos Containing Building Material (ACBM) - Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

8. Asbestos Containing Material (ACM) - Any material containing more than 1 percent asbestos by weight.

9. Barrier - Any surface that seals off the work area to inhibit the movement of fibers.

10. Category I Nonfriable ACM - Asbestos-containing packings, gaskets, resilient floor covering and asphalt roofing products containing more than one percent (1%) asbestos as determined using the method specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy.

11. Category II Nonfriable ACM - Any material, excluding category I nonfriable ACM, containing more than one percent (1%) asbestos as determined using the methods specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.
12. Containment - Area where asbestos abatement project is conducted. Area must be enclosed either by a glove bag or plastic sheeting barrier.

13. Contractor's Competent Person (Qualified Person) - One who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f); in addition, for Class I, II, III, and IV work, who is specially trained in training courses which meet the criteria of EPA's Model Accreditation Plan (40 CFR Part 763) for project designer or supervisor, or its equivalent.

14. Decontamination Area - Enclosed area adjacent and connected to the regulated area which is used for decontamination of workers, materials, and equipment that are contaminated with asbestos.

15. Demolition - the wrecking or taking out of any load bearing structural member of a facility together with any related handling operations.

16. Disposal Bag - A properly labeled 6 mil. thick leak-tight plastic bag used for transporting asbestos waste from work area to disposal site.

17. Encapsulant (Sealant) - A liquid material which can be applied to asbestos-containing material and which prevents the release of asbestos fibers from the material either by creating a membrane over the surface or by penetrating into the material and binding its components together.


19. Enclosure - The construction of an airtight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.

20. Friable Asbestos Material - Any material containing more than one percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763 section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

21. Glove Bag - A manufactured or fabricated device, typically constructed of six (6) mil transparent polyethylene or polyvinyl chloride plastic. This device consist of two (2) inward projecting long sleeves, an internal tool pouch and an attached, labeled receptacle for asbestos waste.

22. Homogeneous Work Site - Continuous areas with the same type of ACM and in which one type of abatement process is performed.

23. Negative Initial Exposure Assessment - An assessment by a "Competent Person" in which it is concluded that employee exposures during the job are likely to be consistently below the Permissible Exposure Levels.

24. Outside Air - Air outside of the containment.
25. Owner's Air Monitoring Firm - Air Monitoring conducted by a person who is not under the direct control of the person carrying out the asbestos abatement project and who has been selected by the Owner.

26. Owner's Air Sampling Professional - An individual who holds a valid certification from the State of Missouri. The individual shall conduct, oversee, or be responsible for air monitoring of asbestos abatement projects before, during, and after the project has been completed. The air sampling professional must hold a 40 hour AHERA Asbestos Contractor/Supervisor Certificate, and supervised by the Owner's Certified Industrial Hygienist (C.I.H.).

27. Owner's Air Sampling Technician - An individual who has been trained by and is under the supervision of an air sampling professional to do air monitoring before, during, and after the asbestos abatement project. The air sampling technician must hold a 40 hour AHERA Asbestos Contractor/Supervisor Certificate, and be supervised by the Owner's Certified Industrial Hygienist (C.I.H.).

28. Owner's Certified Industrial Hygienist (C.I.H.) - an Industrial Hygienist, Certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Owner's C.I.H. must also be certified by the Missouri Department of Natural Resources as an air sampling professional and hold a 40 hour AHERA Asbestos Contractor/Supervisor Certificate. The Owner will identify C.I.H. before application for permit.

29. Personal Monitoring - Sampling of the asbestos fiber concentrations within the breathing zone.

30. Regulated Asbestos Containing Material (RACM) - Friable asbestos material; Category I nonfriable ACM that has become friable; Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

31. Remove - To take out RACM or facility components that contain or are covered with RACM from any facility.

32. Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component.

33. Repair - The restoration of asbestos material that has been damaged. Repair consists of the application of rewetable glass cloth, canvas, cement or other suitable material. It may also involve filling damaged areas with non-asbestos substitutes and re-encapsulating or painting previously encapsulated materials.

34. Strip - To take off RACM from any part of a facility or facility components.

35. Waste Shipment Record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos containing waste material.
36. Work Area - A specific isolated area, other than the space enclosed within a glove bag, in which friable asbestos-containing materials is required to be handled. The area is designated as a work area from the time that the area is secured and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

1.3 CODES AND REGULATIONS

1. General Applicability Of Codes, Regulations and Standards - All applicable codes, regulations, standards, statutes, laws, and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. Where conflicts arise, the most stringent specification shall apply.

2. Contractor Responsibility - The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, or other regulations on the part of the contractor, contractor's employees, or contractor's subcontractors.

3. Federal and State requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

   1. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) including but not limited to:


   2. U.S. Environmental Protection Agency (EPA) including but not limited to:

3. U.S. Department of Transportation (DOT) including but not limited to:


4. State of Missouri including but not limited to:

   1. H.B. 77, 85th General Assembly.

   2. Missouri Air Conservation Law Chapter 643.

   3. Missouri Department of Natural Resources, Division 10, Chapter 6 of the Code of State Regulations as follows:

      (1) 10 CSR 10-6.020, Definitions

      (2) 10 CSR 10-6.080, Emission Standards for Hazardous Air Pollutants

      (3) 10 CSR 10-6.230, Administrative Penalties

      (4) Volume 18, Missouri Register, Page 44

      (5) 10 CSR 10-6.250, Asbestos Abatement Projects - Certification, Accreditation, and Business Exemption Requirements

1.4 NOTIFICATIONS

1. Notifications meeting the requirements of Volume 18, Missouri Register, page 44, shall be completed and sent by the Contractor not less than ten (10) days before the intended starting date of the project. Send notification to the following:

   1. Department of Natural Resources
      Air Pollution Control Program (Asbestos)
      P.O. Box 176
      Jefferson City, Missouri 65102

   2. U.S. Environmental Protection Agency
      Region VII
      Air & Toxic Division, Air Branch
      ATTN: Air Compliance
      726 Minnesota Avenue
      Kansas City, Kansas 66101

   3. Provide a copy to the Owner's Representative. Five (5) day notification to the Owner's Representative is required on jobs less than the reportable quantity.
4. If the project is under the jurisdiction of the Kansas City Air Quality Section, St. Louis County Air Pollution Control Branch, or the Springfield-Green County Air Pollution Control Authority, send notification directly to the appropriate agency.

1.5 SUBMITTALS

1. The following will be submitted by contractor prior to commencement of work for approval by the Owner's Certified Industrial Hygienist (one copy for the Owner's Representative). Owner's C.I.H. will return reviewed copies to contractor and Owner's Representative.

   1. One copy of material safety data sheets (MSDS) for products to be used by the Contractor in the performance of his work. Contractor will also maintain copies of MSDS on site per OSHA.

   2. One copy of the notifications to, or any correspondence with, the regulatory agencies. Submit a listing of all prior regulatory violations.

2. Friable Abatement:

   1. Current Certificates of training and statement of qualifications for the project asbestos abatement supervisor and the Missouri Asbestos Occupational Certificates for all project personnel. List a summary of project personnel and contact phone numbers.

   2. Name, address, and contact person's name of testing laboratory or laboratories to be utilized analyzing samples for bulk analysis or air samples.

   3. Submit a detailed plan of the procedures proposed for use in complying with requirements of this specification and Volume 18, Missouri Register, page 44, and 29 CFR 1926.1101. Include in the plan the layout and location of barriers, decontamination units, route of ingress and egress for work area, methods used to assure safety of building occupants and visitors, methods used to isolate or closing out of HVAC system, personal air monitoring strategy, method of removal of material, and engineering controls utilized to prevent emissions from the work area.

   4. Provide a disposal plan to detail type of disposal container, method of transportation to disposal site, waste hauler, and disposal site.

   5. Copy of notifications required as part of the emergency notification plan.

3. Non-Friable Abatement:

   1. Submit a detailed plan of the procedures proposed to minimize emissions and to prevent the material from becoming friable during removal.

   2. Copy of emergency protection plan to be used if the nonfriable material should become friable during removal.
3. Current Certificates of training and statement of qualifications for the "Competent Person".

4. One copy of the Negative Initial Exposure Assessment.

4. Upon completion of the abatement work, the following information shall be submitted to the Owner's Representative.

1. Waste disposal receipts and waste shipment record on all asbestos waste removed from the project.

5. Upon completion of the abatement work, the following information shall be submitted by the Owner's C.I.H. to the Contractor.

1. Air sampling test results for personal (non-OSHA) and final clearance air samples taken under the supervision of Owner's Certified Industrial Hygienist. Results must be in writing in final report form.

2. Written certification from the Owner's Certified Industrial Hygienist.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SUPERVISION OF ABATEMENT

1. The Contractor shall designate a competent supervisor subject to the approval of the Owner's C.I.H. and the Owner's Representative. The supervisor shall be the Contractor's representative on the project and shall meet the requirements of all applicable regulations and perform the following minimum requirements.

   1. Be Certified by the State of Missouri as an Asbestos Abatement Supervisor, a minimum of one year prior full time experience in asbestos abatement work and a minimum of two years experience as a supervisor, and be qualified as a Competent Person in accordance with OSHA regulation 1926.1101.

   2. Be on site and supervise all abatement work in accordance with OSHA and Volume 18, Missouri Register, page 44.

   3. Conduct all OSHA required air monitoring.

   4. Maintain a daily log on the project documenting events, visitations, problems, equipment failures, accidents, and inspections.

   5. Be responsible for implementation of first aid, safety training, respiratory protection, and ensuring all workers are trained in emergency procedures.
6. Be responsible for conducting a visual inspection of the work area prior to a visual inspection by the Owner's Certified Industrial Hygienist. Inspection shall be documented.

3.2 NEGATIVE INITIAL EXPOSURE ASSESSMENT

1. The Contractor must conduct a Negative Initial Exposure Assessment (non-friable asbestos) prior to removal of the asbestos material. The Negative Initial Exposure Assessment shall be performed by a "Competent Person" to determine whether the material may be removed and maintained in a nonfriable condition. If the material cannot be removed without becoming friable then the contractor shall comply to the requirements in this specification at no additional cost to the Owner.

2. The method of removal is the Contractor's option. However, in the event of any of the following:

   1. Visible emissions are observed

   2. Sanding, grinding, cutting, or abrading of the material

   3. Air samples exceed 0.1 f/cc

   The contractor shall immediately stop work, implement corrective work practices, make any necessary notifications to all regulatory agencies of the changes in work practices and material conditions, and comply with the requirements as set forth in this specification.

3.3 WORKER PROTECTION & TRAINING

1. The Contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, written respirator program, medical examinations, maintaining medical records, and protective clothing and equipment to comply with OSHA requirements.

2. The Contractor shall be responsible for all testing and costs incurred for complying with requirements of OSHA regulations for Personal Air Sampling.

3. All workers shall be trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and protective measures.

4. All workers shall hold valid diplomas as accredited Asbestos Abatement Workers as required by 10 CSR 10-6.250.
3.4 INDEPENDENT TESTING LABORATORY

1. Testing Laboratories utilized by the Contractor for sample analysis during the project shall meet the following minimum requirements and be approved by the Owner's C.I.H. This information shall be submitted to the Owner's Representative for review.

   1. All air monitoring samples shall be analyzed by a testing laboratory accredited by the American Industrial Hygiene Association (AIHA) or by an individual who is currently on the Asbestos Analyst Registry.

   2. All bulk samples shall be analyzed by a testing laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

3.5 OWNER'S AIR SAMPLING PROFESSIONAL & CERTIFIED INDUSTRIAL HYGIENIST

1. It will be the Owner's responsibility to hire an Air Sampling Professional & Certified Industrial Hygienist. The Air Sampling Professional & Industrial Hygienist will also be required to perform the following duties as a minimum:

   1. Approval of the Contractor's work plan and methods of abatement to meet regulatory requirements and ensure the health and safety of University faculty, staff, and students.

   2. Verify that the contractor is satisfactorily performing personal air monitoring as directed by OSHA regulations.

   3. Visual inspection of the work area and final clearance air monitoring.

   4. Certify in writing that the Contractor's procedures, methods and practices were, to the best of my knowledge and belief, in compliance with current EPA, OSHA, State and/or applicable local regulations and that the work areas meet the requirements for final clearance testing and account of any known deviations.

   5. Issue final air clearance.

3.6 EMERGENCY PROTECTION PLAN

1. The contractor shall be responsible for developing a written Emergency Protection Plan and shall maintain this plan on site. The plan shall include considerations of asbestos leakage from the site, fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

2. Emergency protection plan shall also include written notification of police, fire and medical personnel of the planned abatement activities, work schedule, and layout of work area, particularly barriers that may affect response capabilities.
3.7 LOCAL AREA PROTECTION & SITE SECURITY

1. The contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner.

2. Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations required of Contractor's employees.

3. The contractor shall have control of site security during abatement operations in order to protect work environment and equipment. Contractor shall have the owners assistance in notifying building occupants of impending activity and enforcement of restricted access by owners employees.

4. The contractor shall keep a minimum of two 10 lbs. type ABC fire extinguishers on site. One shall be maintained outside the work area and one inside the work area. The employees shall be trained in the operation of extinguishers.

5. Where areas cannot be isolated by existing walls and doors from employees, clients, or the public, barriers must be constructed of 1/2" plywood and 2"x4" framing 16" o.c. to isolate the area. The barriers must be installed in such a manner to prevent damage to existing walls, floors, or ceilings. Barrier may have a lockable door.

6. The contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean, safe working area.

7. The Contractor shall provide warning signage around the regulated area as required by OSHA.

8. The Contractor shall isolate any and all air supply and returns to the abatement space as required by OSHA. Contractor shall coordinate with the Owner's Representative.

9. The Contractor shall keep all areas where adhesive stripper is in use (such as mastic removal) under negative pressure and exhausted to the outside ambient air.

3.8 FINAL CLEARANCE REQUIREMENTS (FRIABLE ASBESTOS)

1. Upon completion of the abatement work, the supervisor shall perform a visual inspection of the work area. If satisfactory, the supervisor shall then request the Owner's C.I.H. or the C.I.H.'s air sampling technician to perform a visual inspection. When the Owner's C.I.H. feels the area is ready based on the results of their visual inspection, the Contractor shall apply a lockdown encapsulant. Following application of lockdown encapsulant, the Owner's C.I.H. shall perform the final clearance sampling for airborne fiber concentrations.

2. The Owner's C.I.H. or designee will perform final clearance testing per the following requirements:
1. Aggressive sampling shall be required for all areas where removal has taken place with the exception of glove bag projects where nonaggressive sampling is permitted.

2. P.C.M. samples analyzed on site shall be counted by an accredited registered microscopist.

3. For areas specifically specified for clearance by Transmission Electron Microscopy, the method shall be NIOSH 7402.

3. Any work areas failing to meet the clearance requirements of this section shall be recleaned and retested at the contractor's expense until satisfactory levels are obtained.

4. The Owner's C.I.H. shall provide a written report of the air monitoring activities to the contractor within 7 days after the final clearance testing.

3.9 REESTABLISHMENT OF THE WORK AREA AND SYSTEMS

1. Reestablishment of the work area shall only occur after the contractor has received final clearance in writing from the Owner's C.I.H.

2. All damage to finishes, equipment, and/or the area affected by the abatement shall be repaired by the contractor to equal or better condition as it was prior to the work, at no cost to the owner.

3.10 WASTE DISPOSAL

1. All asbestos containing waste and/or asbestos contaminated debris shall as a minimum be double bagged in approved 6 mil. disposal bags. Each bag shall be tagged to meet requirements of NESHAPS with an asbestos caution label and a source identification label.

2. Transportation shall meet the requirements of all regulatory agencies for asbestos containing materials and shall be transported in an enclosed truck.

3. The waste disposal site shall be approved by the Missouri Department of Natural Resources for asbestos disposal. A chain of custody letter/waste shipment record and disposal receipts shall be provided to the owner for all materials disposed of.

3.11 DRAWINGS

1. Drawings, when provided, are not intended to be used for anything but a "reference" to the work area. Information is not specific to quantities or to exact location of ACM unless explicitly noted. Contractor will be required to field verify the conditions and quantities.
3.12 REPORTS

1. Reports, when provided, are intended to be used as a basis for the type and composition of the asbestos present for both bidding purposes and for the information required for the notifications to the governing agencies.
HAZARDOUS BUILDING MATERIALS SURVEY
PROJECT CP181011
LOEB HALL (BLDG. #37-124) DEMOLITION
7/26/2019

TO: Mark Hoerstkamp
    Planning, Design, and Construction

FROM: Pete Kohler
    Environmental Health and Safety

MU EHS has completed a hazardous building material survey of Loeb Hall, prior to its demolition. The survey consists of an asbestos survey, a lead paint survey, RCRA metals testing on materials which may go to clean fill, and an inventory of universal waste.

The asbestos inspection was conducted to satisfy the requirements of 40CFR 61, subpart M, which stipulates that all buildings be “thoroughly inspected” for asbestos before the commencement of renovation or demolition activities. The asbestos inspection was conducted by Pete Kohler (Missouri Asbestos Inspector #10883, expires 11/16/2019). The survey was conducted in June and July, 2019 and the report was completed July 26, 2019.

Representative samples of suspect materials were collected and analyzed. Floor tile was analyzed by TEM. Other samples were analyzed by PLM, with an additional step in preparing hard-to-analyze samples, such as black adhesive mastic from floor tile, and tar (PLM NOB).

Fiberglass and black neoprene were inspected but not necessarily analyzed.

As a result of sampling and analysis, ACM was identified in Loeb Hall.

Some ACM pipe insulation remains in Loeb Hall.
Some flooring material is ACM.
One window in Loeb Hall has ACM caulk.
Fire doors in Loeb are presumed to have asbestos cores.
Loeb Hall is a two story building of brick and concrete, constructed in 1956. It was originally a dining hall, with the cafeteria on the second floor and the kitchen on the first floor. There is one stairwell and an elevator. Two other stairwells in the original building have been abandoned and closed off, but are still in the structure. A dumbwaiter runs in a chase between the two floors.

Loeb Hall is currently used by the Music Department. Many offices on the first floor have been made into practice rooms. Department offices are on the second floor, along with an auditorium and library. There are computer labs, faculty and graduate student offices, mechanical rooms, storage rooms, and common meeting areas. There are four rest rooms, all on the first floor. Mechanical rooms are on the first floor. The elevator equipment is in an attached brick structure on the west side. The building comprises 14,679 square feet.

FIELD OBSERVATIONS

Hallways of the second floor have hard plaster ceilings. The offices and the auditorium (called Lab 201) have open ceilings, up to the concrete deck above. There is no spray-on on the deck. Ductwork is exposed in these rooms.

Library 205 has a splined tile drop ceiling. The ceiling tiles are lightweight metal. Above the metal splined tiles is light fiberglass insulation, with black backing paper. Both the insulation and the paper were sampled and analyzed. It does not contain asbestos.

There are access panels in the plaster ceilings. Above the plaster ceilings, ductwork is sheet metal mains, with fiberglass flex-duct to the vents. The sheet metal ducts often have fiberglass interiors. Older ductwork, some serving as returns, is also insulated with fiberglass on the interiors. Pipe insulation above the ceiling is fiberglass, often with PVC jackets at the elbows. This insulation is relatively new.

The space above the plaster ceiling, with the ductwork and piping, goes up approximately three feet, to another plaster ceiling. Ceiling plaster was sampled and analyzed. It does not contain asbestos.

The flooring on the second floor is mainly sheet vinyl flooring; black, brown, and gray. Each color of sheet vinyl was sampled from various locations, and analyzed. The sheet vinyl flooring does not contain asbestos. The elevator car has sheet vinyl flooring, negative for asbestos. In Vestibule V200, the sheet vinyl was put down over old black mastic, which probably had not been removed from floor tile.
The mastic was found to be negative for asbestos. The floor of Room 206 has residual black mastic on concrete, under carpet tile. Analysis of this material came back inconclusive. A second sample was collected and analyzed. No asbestos was identified.

Library 205 has 12” floor tile, laid with blond mastic. The two colors of floor tile were sampled and analyzed. It does not contain asbestos. The blond mastic is not suspect. Cove base is vinyl throughout. There is no ACM flooring on the 2nd floor.

Walls are gypsum boards, finished at the joints with sheet rock joint compound. In some spots the sheet rock walls are built directly over old plaster walls. In other spots, the plaster walls are exposed. Samples of sheet rock, sheet rock joint compound, and plaster (from both walls and ceiling) were sampled and analyzed. None was found to contain asbestos.

The acoustic panels in Auditorium 201 were sampled and analyzed. The material is negative for asbestos. The panels are held to the walls with glue pucks. The glue is negative for asbestos.

Below the windows of 201, 204, and along exterior walls of Offices 202, 202A and 202B, there are panels from the sill to the floor, and above the windows to the ceiling. The panels themselves are plywood, covered with vinyl. Behind the panels, the spaces are filled with fiberglass batts. The walls of 205 are glazed ceramic block. Piping for a ceiling-hung heater comes through a wall of the block and is insulated with ACM hard mud. It is presumed that the asbestos mud will be found inside the chase as well.
The ceilings of the first floor are mainly drop ceilings, with various styles of 2x2 ceiling tiles. Representative samples of the tiles contain no asbestos.

Above the drop ceilings, pipes are generally insulated with fiberglass or neoprene. Most of the pipe insulation is new, with PVC jackets at the elbows. Ductwork is sheet metal mains, often with fiberglass insulation on the interior, and fiberglass flex-ducts to the vents.

The ceiling of Lab 112 is open to the deck above, similar to the auditorium on the 2nd floor. There is no spray-on. Acoustic panels in the ceiling and on the walls were sampled. The material is negative for asbestos.

The ceilings of the rest rooms are plaster, on spread steel. Rest rooms 122 and 124 have access panels. Above the plaster ceiling, there are pipes with new fiberglass, pipes with old fiberglass which have been stripped at the fittings (where there was once asbestos-containing mud, most likely), and pipes with new fiberglass straights and old ACM fittings. The configuration of these pipes reveals the story of the building. A vast majority of the pipes in the building were stripped and re-insulated; but not all. ACM piping does remain, in limited quantities and in hard-to-reach spots.

The ACM pipes above the plaster ceilings of 122 and 124 drop down into the wall cavities of the rest rooms. It seems likely that there is ACM pipe insulation inside the wall cavities of these rest rooms. It is presumed that other pipes will become uncovered which are still insulated with asbestos.

A pipe in the southeast corner of 104A has asbestos insulation. A pipe in Mechanical Room 117 has asbestos insulation.

The large mechanical room, 109, has had the ACM insulation removed. The pipes have been re-insulated, or they remain bare, but no suspect material was identified in the main mechanical room.
Walls are sheet rock or plaster, as on the 2nd floor. Sheet rock joint compound and plaster were sampled and analyzed. All samples are negative for asbestos.

The floor of the 1st floor is red ceramic tile, often with carpet tile or roll carpeting on top, or with 12” floor tile on top. The 12” tile is sometimes laid over 9” tile, which has been laid on the ceramic tile. Two and three layers of flooring is not uncommon on the 1st floor. Usually one (or more) of the layers has been put down with black adhesive mastic. I collected samples of various styles, sizes, and colors of the floor tile. The green 9” floor tile, found as a bottom layer in many places, is positive for asbestos. Some 12” tile is positive; some 12” tile is negative. The black mastic is generally positive, but several samples were found to be negative. I have included a floor plan to identify positive flooring. Since the building is being razed, all asbestos-containing flooring must be removed.

Windows throughout the building are aluminum inserts. I collected window glazing compound and window caulk from various locations. The caulk is negative for asbestos, except for the window in Room 119, which has ACM caulk. The window in 119 is unique in Loeb Hall, and uses different window glazing compound. The glazing compound in 119 contains <1% asbestos, and the whole unit should be treated as ACM, wrapped and disposed of properly.
The roof is EPDM, beneath a rock ballast. Under the EPDM is EPS foam, on top of a vapor barrier of asphalt and felt, on a concrete deck. Each component of the roof was analyzed separately. The roofing material does not contain asbestos.

The same material was found on the roof of the penthouse. The penthouse roof does not contain asbestos. There are six circular structures on top of the penthouse, each covered with plywood and EPDM. These are, possibly, the ducts which remain from the original kitchen, when Loeb was a dining hall. Beneath the EPDM, I found the round forms to be concrete, which I sampled. The ducts do not contain asbestos. They are NOT transite. The tar that holds the EPDM to the round forms was sampled and analyzed. It does not contain asbestos. Other samples of caulk, sealants, and an asphalt residue on the roof were analyzed. None of these samples was found to contain asbestos.

Caulk from an exterior louvre was analyzed. It does not contain asbestos. In several places, the exposed concrete foundation is coated with waterproofing tar. Tar samples were analyzed. The tar was found to contain <.25% asbestos. To qualify as Asbestos-containing material, the tar would have to be more than 1%. As non-friable material, with a minute concentration of asbestos, it does not qualify as ACM, and does not need to be removed from the concrete before the demolition of the building.

The elevator car door does not contain asbestos insulation. The elevator hatch doors are not insulated. Elevator brake shoes are presumed to be ACM.

There are 18 fire doors throughout Loeb. Fire doors are presumed to have asbestos cores. They may be stored for re-use, only if all the hardware remains intact. If they are to be discarded, or if any hardware must be removed, it is an asbestos job, and needs to be completed by asbestos-certified workers.

There are many walls in Loeb made of cinder block. I was able to see into many, and I poked holes in others, and found no evidence of loose fill insulation. But the possibility exists that loose fill may be uncovered as the building is razed. If any loose fill is found, please contact EHS and we can sample if needed. It is always possible that vermiculite was used which may contain asbestos.

At a wall penetration in Mechanical Room 109, a utility line’s insulation was sampled and analyzed. The insulation is positive for asbestos. It is presumed that
the steam and water lines coming into the building will be found to be insulated with ACM. No sampling was done on the utilities outside of Loeb Hall.

<table>
<thead>
<tr>
<th>SAMPLE ID</th>
<th>LOCATION/DESCRIPTION</th>
<th>ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>190618-01</td>
<td>Loeb Hall, Room 109, above entry door, TSI-inside wall, 8” straight</td>
<td>5% quartz, 95% non-fibrous</td>
</tr>
<tr>
<td>190618-02</td>
<td>Room 109, within wall penetration, east wall, TSI-8” straight</td>
<td>40% CHRYSOTILE, 10% AMOSITE, 50% non-fibrous</td>
</tr>
<tr>
<td>190619-01</td>
<td>Vestibule V200, black sheet vinyl flooring</td>
<td>15% synthetic fibers, 85% non-fibrous</td>
</tr>
<tr>
<td>190619-01A</td>
<td>Black mastic from sheet vinyl listed above</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190619-02</td>
<td>C200, gray sheet vinyl flooring</td>
<td>10% cellulose, 90% non-fibrous</td>
</tr>
<tr>
<td>190619-03</td>
<td>206, residual black mastic</td>
<td>&lt;.43% chrysotile, 99%+ matrix material INCONCLUSIVE-See sample 190718-01</td>
</tr>
<tr>
<td>190619-04</td>
<td>201, gray sheet vinyl flooring</td>
<td>15% synthetic fibers, 85% non-fibrous</td>
</tr>
<tr>
<td>190619-05</td>
<td>201, brown sheet vinyl flooring</td>
<td>15% synthetic fibers, 85% non-fibrous</td>
</tr>
<tr>
<td>190619-06</td>
<td>202A, window caulk</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190619-07</td>
<td>203, exterior window caulk</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190619-08</td>
<td>204, window caulk</td>
<td>&lt;1% chrysotile, 99%+ non-fibrous INCONCLUSIVE-See sample 190723-01</td>
</tr>
<tr>
<td>190619-09</td>
<td>204, skim coat on panel below window</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Analysis</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
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<tr>
<td>190620-01</td>
<td>104, 12” gray floor tile (blond mastic, no analysis)</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190620-02</td>
<td>104A, TSI-3” straight</td>
<td>25% CHRYSOTILE, 50% cellulose, 25% non-fibrous</td>
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<tr>
<td>190620-03</td>
<td>C102, 12” tan w/flecks floor tile (blond mastic)</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190620-04</td>
<td>C102, 12” white w/gray specks floor tile (blond mastic)</td>
<td>4.9% CHRYSOTILE, 95.1% matrix material</td>
</tr>
<tr>
<td>190620-05</td>
<td>C101, top layer, 12” white w/gray specks floor tile</td>
<td>4.0% CHRYSOTILE, 96% matrix material</td>
</tr>
<tr>
<td>190620-05A</td>
<td>Black mastic from floor tile above</td>
<td>3.6% CHRYSOTILE, 96.4% matrix material</td>
</tr>
<tr>
<td>190620-06</td>
<td>C101 bottom layer, 9” green floor tile</td>
<td>13% CHRYSOTILE, 87% non-fibrous</td>
</tr>
<tr>
<td>190620-06A</td>
<td>Black mastic from floor tile above</td>
<td>2.4% CHRYSOTILE, 97.6% matrix material</td>
</tr>
<tr>
<td>190620-07</td>
<td>112E, gray floor leveler under carpet</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190620-08</td>
<td>112, fiber pad under roll carpet</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190624-01</td>
<td>C102, top layer, 12” white w/gray floor tile (blond mastic, no analysis)</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190624-02</td>
<td>C102, bottom layer, 9” green floor tile</td>
<td>24.8% CHRYSOTILE, 75.2% other</td>
</tr>
<tr>
<td>190624-02A</td>
<td>Black mastic from floor tile above</td>
<td>1.2% CHRYSOTILE, 98.8% other</td>
</tr>
<tr>
<td>190624-03</td>
<td>121, 9” green floor tile</td>
<td>17.8% CHRYSOTILE, 82.2% other</td>
</tr>
<tr>
<td>190624-03A</td>
<td>Black mastic from floor tile</td>
<td>1.1% CHRYSOTILE, 98.9% other</td>
</tr>
<tr>
<td>190624-04</td>
<td>119, top layer, 12” white w/aqua streaks floor tile (blond mastic)</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Chrysotile Content</td>
</tr>
<tr>
<td>--------</td>
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<td>-----------------------------</td>
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<tr>
<td>190624-05</td>
<td>119, bottom layer, 9” green floor tile</td>
<td>9.2% CHRYSOTILE, 90.8% other</td>
</tr>
<tr>
<td>190624-05A</td>
<td>Black mastic from floor tile above</td>
<td>1.6% CHRYSOTILE, 98.4% other</td>
</tr>
<tr>
<td>190624-06</td>
<td>119, window caulk</td>
<td>3% CHRYSOTILE, 97% non-fibrous</td>
</tr>
<tr>
<td>190624-07</td>
<td>118, 12” white w/black specks floor tile</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190624-07A</td>
<td>Black mastic from floor tile above</td>
<td>100% matrix material</td>
</tr>
<tr>
<td>190624-08</td>
<td>Finish coat</td>
<td></td>
</tr>
<tr>
<td>190624-08A</td>
<td>Base coat</td>
<td></td>
</tr>
<tr>
<td>190624-08B</td>
<td>Texture</td>
<td></td>
</tr>
<tr>
<td>190624-09</td>
<td>C103, wall plaster</td>
<td></td>
</tr>
<tr>
<td>190624-10</td>
<td>C100, sheet rock joint compound</td>
<td></td>
</tr>
<tr>
<td>190624-11</td>
<td>108, sheet rock joint compound</td>
<td></td>
</tr>
<tr>
<td>190624-12</td>
<td>119, exterior, window glazing compound</td>
<td>&lt;1% chrysotile, 99%+ non-fibrous</td>
</tr>
<tr>
<td>190624-13</td>
<td>Exterior foundation, waterproofing tar</td>
<td>&lt;0.25% chrysotile, 99%+ other</td>
</tr>
<tr>
<td>190624-14</td>
<td>Exterior foundation, waterproofing tar</td>
<td>&lt;0.25% chrysotile, 99%+ other</td>
</tr>
<tr>
<td>190624-15</td>
<td>Exterior foundation east side, at louver, caulk</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190624-16</td>
<td>206, wall plaster</td>
<td></td>
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<tr>
<td>190624-17</td>
<td>C200, by 201, sheet rock joint compound</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190624-18</td>
<td>201, sheet rock joint compound</td>
<td></td>
</tr>
<tr>
<td>190624-19</td>
<td>201A, sheet rock joint compound</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Material Composition</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
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<tr>
<td>190624-20</td>
<td>204, sheet rock joint compound</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190624-21</td>
<td>202, sheet rock joint compound</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190624-22</td>
<td>Lobby L100, 2x2 ceiling tile, gray body</td>
<td>50% cellulose, 30% mineral wool, 15% perlite, 5% non-fibrous</td>
</tr>
<tr>
<td>190624-23</td>
<td>C100, outside of 106, 2x2 ceiling tile, gray body</td>
<td>50% cellulose, 30% mineral wool, 15% perlite, 5% non-fibrous</td>
</tr>
<tr>
<td>190624-24</td>
<td>108, 2x2 ceiling tile, gray body</td>
<td>50% cellulose, 30% mineral wool, 15% perlite, 5% non-fibrous</td>
</tr>
<tr>
<td>190625-01</td>
<td>111, 2x2 ceiling tile, gray body</td>
<td>50% cellulose, 30% mineral wool, 10% perlite, 10% non-fibrous</td>
</tr>
<tr>
<td>190625-02</td>
<td>111, above ceiling, sheet rock joint compound</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190625-03</td>
<td>finish coat</td>
<td>C101, wall plaster</td>
</tr>
<tr>
<td>190625-03A</td>
<td>base coat</td>
<td>C101, wall plaster</td>
</tr>
<tr>
<td>190625-04</td>
<td>C200, access panel, duct cement</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190625-05</td>
<td>C200, access panel, ceiling plaster</td>
<td>2% cellulose, 60% gypsum, 5% perlite, 33% non-fibrous</td>
</tr>
<tr>
<td>190625-06</td>
<td>C200, 2nd access panel, ceiling plaster</td>
<td>2% cellulose, 60% gypsum, 5% perlite, 33% non-fibrous</td>
</tr>
<tr>
<td>190625-07</td>
<td>C200, 2nd access panel, sheet rock joint compound</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190625-08</td>
<td>C200, 3rd access panel, ceiling plaster</td>
<td>2% cellulose, 60% gypsum, 5% perlite, 33% non-fibrous</td>
</tr>
<tr>
<td>190626-01</td>
<td>112, acoustic panel on wall</td>
<td>95% glass, 5% non-fibrous</td>
</tr>
<tr>
<td>Date</td>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
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<tr>
<td>190716-01</td>
<td>112</td>
<td>acoustic panel on ceiling</td>
</tr>
<tr>
<td>190717-01</td>
<td>201</td>
<td>acoustic panel on wall</td>
</tr>
<tr>
<td>190717-02</td>
<td>205</td>
<td>insulation from top of 12&quot; metal splined tile</td>
</tr>
<tr>
<td>190717-03</td>
<td>205</td>
<td>black backing paper from insulation</td>
</tr>
<tr>
<td>190717-04</td>
<td>201</td>
<td>blackboard</td>
</tr>
<tr>
<td>190717-05</td>
<td>201</td>
<td>glue puck from behind acoustic panel</td>
</tr>
<tr>
<td>190717-06</td>
<td>205</td>
<td>12&quot; white floor tile (blond mastic no analysis)</td>
</tr>
<tr>
<td>190717-07</td>
<td>205</td>
<td>gray leveler from floor tile</td>
</tr>
<tr>
<td>190717-08</td>
<td>205</td>
<td>12&quot; blue floor tile</td>
</tr>
<tr>
<td>190718-01</td>
<td>206</td>
<td>residual black mastic on concrete</td>
</tr>
<tr>
<td>190722-01</td>
<td>asphalt</td>
<td>ROOF CORE, center- vapor barrier (asphalt)</td>
</tr>
<tr>
<td>190722-01</td>
<td>felt</td>
<td>Vapor barrier (felt)</td>
</tr>
<tr>
<td>190722-01A</td>
<td></td>
<td>ROOF CORE, center- EPS foam</td>
</tr>
<tr>
<td>190722-02</td>
<td>asphalt</td>
<td>ROOF CORE, west edge-vapor barrier (asphalt)</td>
</tr>
<tr>
<td>190722-02</td>
<td>felt</td>
<td>Vapor barrier (felt)</td>
</tr>
<tr>
<td>190722-02A</td>
<td></td>
<td>ROOF CORE, west edge-EPS foam</td>
</tr>
<tr>
<td>190722-03</td>
<td></td>
<td>ROOF- north side- asphalt mat residue</td>
</tr>
<tr>
<td>190722-04 asphalt</td>
<td>ROOF CORE, penthouse mechanical room- vapor barrier (asphalt)</td>
<td>&lt;0.25% glass, 99%+ matrix material</td>
</tr>
<tr>
<td>190722-04 felt</td>
<td>Vapor barrier (felt)</td>
<td>&lt;0.25% mineral wool, 99%+ other</td>
</tr>
<tr>
<td>190722-05</td>
<td>Round ducts (covered with EPDM) on penthouse roof</td>
<td>20% quartz, 80% non-fibrous</td>
</tr>
<tr>
<td>190722-05A</td>
<td>Tar from duct material listed above</td>
<td>3.9% quartz, 96.1% non-fibrous</td>
</tr>
<tr>
<td>190722-06</td>
<td>Gray caulk from north side of penthouse</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190722-07</td>
<td>Gray caulk from south side of penthouse</td>
<td>100% non-fibrous</td>
</tr>
<tr>
<td>190723-01</td>
<td>204, window caulk</td>
<td>4% cellulose, 96% non-fibrous</td>
</tr>
</tbody>
</table>

**ASBESTOS SUMMARY:**
Pipe insulation in Loeb Hall is generally fiberglass or neoprene, but not completely. **SOME ACM pipe insulation remains. Any suspect TSI, which is not clearly fiberglass or neoprene is presumed positive, or must be sampled and analyzed.** Pipes within wall cavities, and pipes in hard-to-reach places that may become accessible as demolition progresses, may reveal asbestos insulation. 104A, 122, 124, 117, and 205 have ACM pipe insulation. It is reasonable to assume that more will be discovered. A conservative estimate on ACM piping is 200 linear feet.

There are 1610 square feet of asbestos-containing flooring in Loeb, all on the 1st floor. It consists of 9” floor tile, 12” floor tile, adhesive black mastic, and potentially floor leveler. In some locations, there are two layers of floor tile, on top of one another. A floor plan is included to identify the positive flooring.

The window in Room 119 has positive caulk around the perimeter of the window.

There are eighteen fire doors in Loeb. The fire doors are presumed to have asbestos cores.
LEAD SURVEY

MU EHS has completed a lead survey of Loeb Hall. The purpose of this survey is to identify lead paint that might represent a potential worker safety hazard and/or might require special handling.

The EPA and the U.S. Department of Housing and Urban Development (HUD) consider lead-based paint as containing a lead concentration equal to or greater than 1.0 milligram per square centimeter (mg/cm²) or 0.5% lead by weight, as defined by Title X of the 1992 Housing and Community Development Act. The US Consumer Product Safety Commission considers paint with up to 600 ppm of lead to be “Lead Free”.

Finished surfaces were tested for lead, using a Niton XL2 analyzer. The XL2 was checked before each session of the survey and found to be in calibration. The survey was made by Pete Kohler (Missouri Lead Inspector #00783, expires 5/17/21.) The lead survey was conducted in July, 2019.

OSHA has found that certain work, including aggressive disturbance of the painted surface, may result in lead levels exceeding the Action Level or the Permissible Exposure Limit (PEL), even when the concentration is below 1 mg/cm².

<table>
<thead>
<tr>
<th>LOCATION/DESCRIPTION</th>
<th>LEAD READINGS (mg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loeb Hall, 2nd floor, South entry, Vestibule V200, white metal entry doors</td>
<td>0.02, 0.03, 0.02, 0.01</td>
</tr>
<tr>
<td>White metal door/window frames</td>
<td>0.12, 0.18, 0.06</td>
</tr>
<tr>
<td>Vestibule V200, white plaster walls</td>
<td>0.01, 0.02, 0.02, 0.01</td>
</tr>
<tr>
<td>Office 206, white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>206, brown plaster wall</td>
<td>0.01, 0.01</td>
</tr>
<tr>
<td>206, varnished door</td>
<td>0.01, 0.01</td>
</tr>
<tr>
<td>Description</td>
<td>Measurements</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>--------------</td>
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<tr>
<td>206, white metal door frame</td>
<td>0.01, 0.02</td>
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<tr>
<td>Stairwell S200, gray metal door</td>
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<tr>
<td>S200, gray metal door frame</td>
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<td>Elevator E200, white metal door/frame</td>
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<td>Corridor C200 (lobby) white sheet rock walls</td>
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<td>C200, white cinder block wall</td>
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</tr>
<tr>
<td>C200, gray lockers along east wall</td>
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<tr>
<td>C200, gray sheet rock wall</td>
<td>0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>Library 205, white glazed ceramic block walls</td>
<td>0.02, 0.01, 0.04, 0.03, 0.03, 0.01, 0.01</td>
</tr>
<tr>
<td>205, varnished door</td>
<td>0.01, 0.01</td>
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<tr>
<td>205, white metal door frame</td>
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<tr>
<td>Lab 204, white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>204, white vertical vinyl blinds</td>
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</tr>
<tr>
<td>204, varnished door</td>
<td>0.01, 0.01</td>
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<tr>
<td>204, white metal door frame</td>
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<tr>
<td>203, white sheet rock walls</td>
<td>0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>203, white metal window frames</td>
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<tr>
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<tr>
<td>203, white metal door frame</td>
<td>0.01, 0.01</td>
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<tr>
<td>Corridor C200 (north/south hallway to north entrance), white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>Description</td>
<td>Dimensions</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Corridor C200 (north/south) white metal door frame</td>
<td>0.83, 0.15, 0.18</td>
</tr>
<tr>
<td>Corridor C200 (north/south) white metal entrance door to north</td>
<td>0.81, 1.61, 1.12</td>
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<tr>
<td>corridor C200 (east/west to Office 202), white sheet rock walls</td>
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<td>Office 202, varnished door</td>
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<td>202, white sheet rock walls</td>
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<tr>
<td>202, white cinder block walls</td>
<td>0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>202, dark blue sheet rock wall</td>
<td>0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>202B, varnished door</td>
<td>0.01, 0.01</td>
</tr>
<tr>
<td>202B, white metal door frame</td>
<td>0.01, 0.01</td>
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<tr>
<td>202B, white sheet rock walls</td>
<td>0.01, 0.01, 0.01</td>
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<tr>
<td>202B, white metal window frames</td>
<td>0.26, 0.07, 0.11</td>
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<tr>
<td>202B, white vinyl vertical blinds</td>
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<td>202A, white metal door frame</td>
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<tr>
<td>202A, varnished door</td>
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<td>202A, light blue sheet rock wall</td>
<td>0.04, 0.02</td>
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<tr>
<td>202A, white metal window frames</td>
<td>0.31, 0.08, 0.15</td>
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<tr>
<td>202, silver metal window</td>
<td>0.01, 0.01</td>
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<td>Lab 201, varnished doors</td>
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<td>201, white metal door frames</td>
<td>0.01, 0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>201, gray sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------</td>
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<tr>
<td>201</td>
<td>gray mini-blinds</td>
</tr>
<tr>
<td>201</td>
<td>white metal window frames, east side</td>
</tr>
<tr>
<td>201</td>
<td>silver windows, east side</td>
</tr>
<tr>
<td>201</td>
<td>gray metal door frame, south side</td>
</tr>
<tr>
<td>201</td>
<td>dark gray metal door, south side</td>
</tr>
<tr>
<td>201A</td>
<td>white sheet rock walls</td>
</tr>
<tr>
<td>201A</td>
<td>varnished door</td>
</tr>
<tr>
<td>201A</td>
<td>white metal door frame</td>
</tr>
<tr>
<td></td>
<td>Loeb Hall, 1\textsuperscript{st} floor, North entry, white metal door</td>
</tr>
<tr>
<td></td>
<td>North entry, blue metal door frames</td>
</tr>
<tr>
<td></td>
<td>Corridor C103, white sheet rock walls</td>
</tr>
<tr>
<td>119</td>
<td>varnished door</td>
</tr>
<tr>
<td>119</td>
<td>blue metal door frame</td>
</tr>
<tr>
<td>119</td>
<td>white sheet rock wall</td>
</tr>
<tr>
<td>119</td>
<td>white cinder block walls</td>
</tr>
<tr>
<td>Storage 120 (abandoned stairwell)</td>
<td>varnished door</td>
</tr>
<tr>
<td>120</td>
<td>tan plaster wall</td>
</tr>
<tr>
<td>120</td>
<td>tan wallpaper on sheet rock</td>
</tr>
<tr>
<td>120</td>
<td>gray metal I-beams overhead</td>
</tr>
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<td>Location &amp; Description</td>
<td>Coordinates</td>
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<tr>
<td>------------------------</td>
<td>-------------</td>
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<tr>
<td>118, blue metal door frame (hallway side)</td>
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<tr>
<td>118, white metal door frame (office side)</td>
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<tr>
<td>118, white sheet rock walls</td>
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<tr>
<td>118, varnished door</td>
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<td>Corridor C103, white sheet rock walls</td>
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<tr>
<td>115, varnished door</td>
<td>0.01, 0.01</td>
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<tr>
<td>115, blue metal door frame</td>
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<tr>
<td>115, white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>Corridor C101, tan sheet rock walls</td>
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<tr>
<td>C101, tan plaster walls</td>
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<td>Vestibule V102, white sheet rock wall</td>
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<td>V102, black metal doors/frames</td>
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<td>121, varnished door</td>
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<tr>
<td>121, tan sheet rock walls</td>
<td>0.01, 0.02, 0.01</td>
</tr>
<tr>
<td>121A, white plaster ceiling</td>
<td>0.03, 0.02</td>
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<tr>
<td>121A, varnished door</td>
<td>0.01</td>
</tr>
<tr>
<td>121A, white sheet rock walls</td>
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<tr>
<td>Women’s room 122, tan metal door</td>
<td>0.22, 0.17</td>
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<tr>
<td>122, blue metal door frame</td>
<td>0.37, 0.38</td>
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<tr>
<td>122, white glazed ceramic block</td>
<td>0.01, 0.04, 0.01</td>
</tr>
<tr>
<td>Item</td>
<td>Reading</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------</td>
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<td>122, brown metal stall dividers</td>
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<tr>
<td>Men’s room 124, tan metal door</td>
<td>0.22, 0.09</td>
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<tr>
<td>124, blue metal door frame (hallway side)</td>
<td>0.22, 0.55</td>
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<tr>
<td>124, black metal door frame (room side)</td>
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<td>124, white glazed ceramic block</td>
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<tr>
<td>Corridor C101, white sheet rock walls</td>
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<tr>
<td>Corridor C100, white sheet rock walls</td>
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<tr>
<td>115, varnished door</td>
<td>0.01, 0.01</td>
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<tr>
<td>115, white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>Practice Rooms 105, 106, 107, 108, and 111 all have white sheet rock walls, white metal door frames, and varnished doors</td>
<td>All readings on these components in these rooms are 0.01 mg/cm²</td>
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<tr>
<td>Practice room 103, white cinder block walls</td>
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<tr>
<td>103, white glazed ceramic block column</td>
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<tr>
<td>Mechanical room 109, white concrete walls</td>
<td>0.04, 0.03, 0.02, 0.03, 0.05</td>
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<tr>
<td>109, white cinder block walls</td>
<td>0.02, 0.03, 0.02</td>
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<tr>
<td>109, tan metal fire doors (exit)</td>
<td>0.02, 0.03, 0.02</td>
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<tr>
<td>109, white fire door (to hallway)</td>
<td>0.37, 0.23, 0.20</td>
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<tr>
<td>109, white metal door frame (hallway side)</td>
<td>0.59, 0.34, 0.07</td>
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<tr>
<td>Description</td>
<td>Coordinates</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>--------------</td>
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<tr>
<td>109, dark gray metal door frame (mechanical room side)</td>
<td>0.17, 0.23</td>
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<tr>
<td>Lobby L100, white sheet rock walls</td>
<td>0.01, 0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>L100, white elevator door/frame</td>
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<tr>
<td>Lab 112, white sheet rock walls</td>
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<tr>
<td>112, white metal door frames (on all storage closets)</td>
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<tr>
<td>112, black metal ductwork in ceiling</td>
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<tr>
<td>112, black concrete ceiling</td>
<td>0.01, 0.01, 0.01</td>
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<tr>
<td>112, black soundproof panels in ceiling</td>
<td>0.01, 0.01, 0.01</td>
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<tr>
<td>112, black sheet rock wall</td>
<td>0.01, 0.01</td>
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<tr>
<td>112, varnished doors (on all storage closets)</td>
<td>0.01, 0.01, 0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>104, gray metal door</td>
<td>0.23, 0.25</td>
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<tr>
<td>104, gray metal door frame</td>
<td>0.18, 0.15</td>
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<tr>
<td>104, white cinder block walls</td>
<td>0.01, 0.02, 0.01</td>
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<tr>
<td>104, white metal door to abandoned stairs</td>
<td>0.38, 0.28, 0.21</td>
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<tr>
<td>104, white metal door frame to stairs</td>
<td>0.14, 0.21</td>
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<tr>
<td>104A, white metal door</td>
<td>0.30, 0.27</td>
</tr>
<tr>
<td>104A, white metal door frame</td>
<td>0.29, 0.13</td>
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<tr>
<td>Loeb Hall exterior, west side, black metal handrails</td>
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<tr>
<td>Description</td>
<td>Coordinates</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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<tr>
<td>Exterior, gray metal door to elevator room</td>
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<tr>
<td>Exterior, gray metal door frame</td>
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<tr>
<td>Exterior, north side, tan metal entry door</td>
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</tr>
<tr>
<td>Tan metal door frame</td>
<td>0.01, 0.01</td>
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<tr>
<td>North side, exterior, 2(^{nd}) floor entry, black handrails</td>
<td>2.43, 1.84</td>
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<tr>
<td>North side, 2(^{nd}) floor, tan metal door</td>
<td>0.47, 0.59, 1.12</td>
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<tr>
<td>North side, 2(^{nd}) floor, tan metal door frame</td>
<td>0.39, 0.48, 0.30</td>
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<tr>
<td>North side, 2(^{nd}) floor, window frame, west of entry door</td>
<td>0.46, 0.62, 0.64</td>
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<tr>
<td>North side, 2(^{nd}) floor, window frame, east of entry door</td>
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</tr>
<tr>
<td>North side, black panel under window</td>
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<tr>
<td>North side, black handrail on roof (west side by I-beam structure)</td>
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<tr>
<td>East side, black handrails</td>
<td>0.01, 0.01, 0.01, 0.01, 0.01, 0.01</td>
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<tr>
<td>East side, black metal doors/frames</td>
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<td>East side, concrete overhang, gray paint</td>
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</tr>
<tr>
<td>South side, black metal handrails</td>
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</tr>
<tr>
<td>South side entry doors, tan metal</td>
<td>0.01, 0.01, 0.01</td>
</tr>
<tr>
<td>South side entry, tan metal door frames</td>
<td>0.01, 0.01, 0.01</td>
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</tbody>
</table>
LEAD SUMMARY:

The metal entry door on the north side of 2nd floor of Loeb is painted with lead-based paint. The black metal handrail leading up three steps to this door is painted with lead-based paint. The door frame for this door and for the window to the west of this door are painted with high-lead paint and it would be prudent to treat them as lead-based.

Several other painted doors and door frames were found to have relatively high concentrations of lead.

UNIVERSAL WASTE

The following items should be removed from Loeb Hall and disposed of properly before demolition. MU EHS Resource Recovery Center (882-3736) can help with barrels for collection of universal waste, and will pick up these items after they have been collected.

- One hundred thirty six (136) four foot fluorescent light fixtures, with their bulbs
- Nine (9) thermostats
- Twenty eight (28) door closers
- Three (3) drinking fountains
- Eighteen (18) exit signs
- Thirteen (13) emergency fire lights
- One smoke detector
- One high energy exterior light, at west side entry

PLEASE NOTE: MU EHS has tested the hydraulic oil in the Loeb Hall elevator. There is no indication of PCBs over 50 ppm, and it may be treated as regular unwanted oil.
ASBESTOS SAMPLE LOCATIONS
LOEB HALL, 1ST FLOOR
PROJECT CP181011
ACM FLOORING
LOEB HALL, 1ST FLOOR
PROJECT CP181011
MU EHS has performed a survey of the Resource Conservation and Recovery Act (RCRA) 8 metals in paint for Project # CP181011– Loeb Hall.

The purpose of this limited RCRA metals in paint survey was to provide information regarding the presence of the following metals on tested components in the Survey Area: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Tested components were those materials that might potentially be reused as clean fill after the building is demolished.

In the Missouri Department of Natural Resources (MDNR) document titled “Using Painted Block and Brick as Clean Fill”, the concentrations specified for the eight RCRA metals include: Silver (Ag) 99 parts per million (ppm)
Arsenic (As) 87 ppm
Barium (Ba) 15,200 ppm
Cadmium (Cd) 429 ppm
Chromium (Cr) 3,285 ppm
Lead (Pb) 4,999 ppm
Mercury (Hg) 100 ppm
Selenium (Se) 50 ppm

Environmental Health and Safety used a Thermo Scientific Niton XL2 (XRF) Analyzer to determine the presence and amount of the RCRA 8 Metals. The RCRA survey was made on July 23, 2019.

Several walls in Loeb gave readings above the standards listed by MO DNR. These elevated readings were all on glazed ceramic block. Two of the walls were ceramic block which was painted and two of the walls were ceramic block which was not painted and which were therefore, just the exposed, glazed surface. The readings are very similar. The source of the elevated readings is the glaze, not the paint. The glazed surfaces of the ceramic material contain the RCRA metals in
concentrations above those allowed by DNR. However, the glaze is fired on. The paint, which is over the glaze (on two of the sample locations) does not trip the DNR standard.

Red brick in Loeb Hall is unpainted.
TABLE 1
RCRA METAL TEST DATA RESULTS
CP181011
University of Missouri
LOEB HALL DEMOLITION

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Ag</th>
<th>As</th>
<th>Ba</th>
<th>Cd</th>
<th>Cr</th>
<th>Hg</th>
<th>Pb</th>
<th>Se</th>
<th>Analysis Results</th>
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<tr>
<td>1</td>
<td>9.6</td>
<td>10.7</td>
<td>672</td>
<td>14.6</td>
<td>112.5</td>
<td>18.6</td>
<td>44</td>
<td>5</td>
<td>less than limit of detection: As, Cd, Cr, Hg, Se</td>
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<tr>
<td>2</td>
<td>9.5</td>
<td>12</td>
<td>1127</td>
<td>14.5</td>
<td>116.7</td>
<td>16.9</td>
<td>56</td>
<td>5</td>
<td>&lt;LOD: Ag, Cd, Cr, Hg, Se</td>
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<tr>
<td>3</td>
<td>894</td>
<td>743</td>
<td>95.4K</td>
<td>1951</td>
<td>4000</td>
<td>700</td>
<td>1914</td>
<td>161</td>
<td>Above MO DNR standards: As, Ba, Cd, Cr, Hg, Se</td>
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<tr>
<td>4</td>
<td>972</td>
<td>634</td>
<td>95.7K</td>
<td>1934</td>
<td>41K</td>
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- Chromium (Cr): 3,285 ppm;
- Mercury (Hg): 100 ppm; and
- Lead (Pb): 4,999 *ppm
- Selenium (Se): 50 ppm.
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<th>Test Number</th>
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Above LOD;

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TO:  Mark Hoerstkamp  
    Planning, Design, and Construction  

FROM:  Pete Kohler  
    Environmental Health and Safety  

MU EHS has completed a hazardous building material survey of specific locations in McReynolds Hall (Bldg. C37-126), and McDavid Hall (C37-125). This survey was made because the demolition of Loeb Hall will involve work in the basement mechanical systems of these buildings, plus additional work in McReynolds that will impact material on each floor.

The inspection was conducted to satisfy the requirements of 40CFR 61, subpart M, which stipulates that all buildings be “thoroughly inspected” for asbestos before the commencement of renovation or demolition activities. The asbestos inspection was conducted by Rudy Zachary (Missouri Asbestos Inspector #14679, expires 11/16/2019) and Pete Kohler (Missouri Asbestos Inspector #10883, expires 11/16/2019), who prepared the report. The survey was conducted in October, 2019 and the report was completed November 4, 2019.

This addendum is intended to expand on the original report for Loeb Hall, dated 7/26/2019, and not to correct any information in that survey.

As a result of the sampling and analysis, ACM was identified in McReynolds Hall, which falls in the scope of the Loeb project. No ACM was identified in McDavid Hall, which will be impacted by the Loeb project.

Some pipe insulation in the pump room of McReynolds contains asbestos.
FIELD OBSERVATIONS

The pump room in McDavid Hall is in the sub-basement, beneath Vestibule V001. Piping in this space is bare metal or is insulated with fiberglass or black neoprene. Fiberglass and neoprene are not suspect materials. The pipe insulation was inspected but not sampled.

The pump room in McReynolds Hall is in the sub-basement, under Stairwell S00G. There is piping in this space that is newly insulated with fiberglass and clad with PVC, pipe with black neoprene, and there is piping that is insulated with older suspect material, which was sampled and analyzed. Some of the suspect insulation is positive for asbestos, and some is negative. Some of the older straights are fiberglass, and some are asbestos-containing material. Some of the hard mud at fittings is non-containing material. The material in this room is a mix of the very new with the very old, and there is no pattern to discern the positive from the negative, other than sampling each section of pipe. Historical data from this room shows the same results. The positive material is hit or miss.

It seems prudent to presume any older material, which is not clearly fiberglass, is ACM; or to sample exactly where the project will impact the suspect material, and identify ACM in specific locations.
The project calls for a vent to be sent vertically out of the pump room, through Rooms 64, 164, 264, 364, 464, and the roof.

Room 64 has carpet tile flooring on white leveler on concrete. The leveler was sampled and analyzed. It does not contain asbestos.

164 has carpet tile on 12” gray floor tile, put down with blond mastic. The mastic is not suspect. The floor tile does not contain asbestos.

264 has roll carpeting put down with green carpet adhesive on concrete. There is no suspect material in 264’s flooring.

364 has carpet tile on white leveler. The leveler is negative for asbestos.

464 has carpet tile on concrete. No suspect material was identified.

The ceilings of these rooms are concrete.

The roof was sampled directly above 464. The roofing is made of a modified rolled roofing, over a perlite board, on ISO foam, with a felt and asphalt vapor barrier on a concrete deck. Each component of the roof core was analyzed separately, using polarized light microscopy (PLM), with an additional step in the preparation of hard to analyze samples with tar or asphalt (PLM NOB). The roofing materials do not contain asbestos.
There are patches that have been added to the roof which use a silver and black material which is often positive for asbestos. I did not sample this material. It would be possible to avoid impacting any of the suspect spots, by moving any penetration a few inches left or right. The silver/black patches are presumed positive for asbestos.

<table>
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<th>SAMPLE ID</th>
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<tr>
<td>191022-01</td>
<td>164 McReynolds, 12” gray floor tile (blond mastic, no analysis)</td>
<td>100% matrix material</td>
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<td>191022-02</td>
<td>364 McReynolds, white floor leveler</td>
<td>100% non-fibrous</td>
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<td>191022-03</td>
<td>64 McReynolds, white floor leveler</td>
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<td>191022-04</td>
<td>McReynolds Pump Room, sub-basement, TSI - 6” 45</td>
<td>15% CHRYSOTILE, 45% mineral wool, 40% non-fibrous</td>
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<td>191022-05</td>
<td>McReynolds Pump Room, sub-basement, TSI - 8” valve</td>
<td>95% mineral wool, 5% non-fibrous</td>
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<td>191022-06</td>
<td>McReynolds Pump Room, sub-basement, TSI - 8” straight at hanger</td>
<td>90% mineral wool, 10% non-fibrous</td>
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<td>191028-02</td>
<td>McReynolds Roof Core- top sheet, modified roll roofing</td>
<td>1.4% quartz, .69% glass, 97.9% matrix material</td>
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<tr>
<td>191028-03</td>
<td>Roof Core- Top layer, w/asphalt</td>
<td>7.4% glass, 92.6% matrix material</td>
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<td>191028-04</td>
<td>Roof Core, perlite w/backing paper</td>
<td>70% cellulose, 10% glass, 10% perlite, 10% non-fibrous</td>
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<td>Roof Core, ISO foam</td>
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<td>191028-06</td>
<td>Roof Core, vapor barrier asphalt (on concrete deck)</td>
<td>3.6% quartz, 1.5% glass, 94.9% matrix material</td>
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Some pipe insulation in the pump room of McReynolds Hall contains asbestos. Any pipe insulation which is not CLEARLY fiberglass or black neoprene is presumed positive for asbestos and needs to be removed by certified asbestos workers; OR sampled at exact locations that will be impacted by the project.
SECTION 230900 - CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. University of Missouri Controls Specification.

B. This section contains requirements for pneumatic, electric and digital control systems as indicated on the contract drawings.

C. Contractor is responsible for providing, installing and connecting all sensors, pneumatic actuators, control valves, control dampers, electrical components and all interconnecting pneumatic tubing and electrical wiring between these devices and up to the Direct Digital Controller (DDC).

D. DDC systems consist of Johnson Controls METASYS controllers. Contractor shall install owner provided control enclosures. Owner will provide and install controllers. After all equipment has been installed, wired and piped, Owner will be responsible for all termination connections at the DDC controller’s and for checking, testing, programming and start-up of the control system. Contractor must be on site at start-up to make any necessary hardware adjustments as required.

E. Once each mechanical system is completely operational under the new control system, contractor shall make any final connections and adjustments. For controls renovation jobs, contractor shall remove all unused sensors, operators, panels, wiring, tubing, conduit, etc. Owner shall have the option of retaining any removed pneumatic controls.

1.2 RELATED SECTIONS

A. Drawings and general provisions of Contract, including General and Special Conditions apply to work of this section.

1.3 QUALITY ASSURANCE

A. Contractor's Qualifications:

1. Contractor shall be regularly engaged in the installation of digital control systems and equipment, of types and sizes required. Contractor shall have a minimum of five years’ experience installing digital control systems. Contractor shall supply sufficient and competent supervision and personnel throughout the project in accordance with General Condition’s section 3.4.1 and 3.4.4.

B. Codes and Standards:

1. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for control systems.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings for each control system, containing the following information:
   B. Product data for each damper, valve, and control device.
   C. Schematic flow diagrams of system showing fans, pumps, coils, dampers, valves, and control devices.
   D. Label each control device with setting or adjustable range of control.
   E. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
   F. Provide details of faces on control panels, including controls, instruments, and labeling.
   G. Include written description of sequence of operation.
   H. Provide wiring diagrams of contractor provided interface and I/O panels.
   I. Provide field routing of proposed network bus diagram listing all devices on bus.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Air Piping:
   1. Copper Tubing: Seamless copper tubing, Type M or L, ASTM B 88; wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment.
   2. Flex Tubing: Virgin Polyethylene non-metallic tubing, ASTM D 2737, with flame-retardant harness for multiple tubing. Use compression or push-on polyethylene fittings. Tubing used above suspended ceilings to be plenum rated per NFPA 90A. See section 3.1.b for locations where flex tubing can be used.
   3. Copper to polyethylene connections shall be compression barbed fittings or solder barbed fittings.

B. Conduit and Raceway:
1. Electrical Metallic Tubing: EMT and fittings shall conform to ANSI C80.3.
2. Surface Metal Raceway and Fittings: Wiremold 500, Ivory, or approved equal.
3. Flexible Metal Conduit: Indoors, per National Electric Code for connection to moving or vibrating equipment.
4. Liquidtight Flexible Conduit: Outdoors, per National Electric Code for connection to moving or vibrating equipment.

C. Control Valves: Provide factory fabricated pneumatic or electric control valves of type, body material, and pressure class as indicated on the drawings. Butterfly style control valves are not acceptable except for two position applications. Equip control valves with heavy-duty actuators, with proper shutoff rating for each individual application.

1. Steam and Hot Water
   a. Manufacturer: Do not allow KMC valves and actuators.
   b. Water Service Valves: Equal percentage characteristics.
   c. Steam Service Valves: Equal percentage characteristics.
   d. Single Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
   e. Valve Trim and Stems: Polished stainless steel.
   g. Control valves should have a minimum 100 psi close-off rating for chilled water applications.

2. Hydronic Chilled Water and Heating Water
   a. At minimum, hydronic control valves shall be pressure independent. High performing energy monitoring control valves may be considered depending on the project. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. The control valve shall accurately control the flow from 1 to 100% full rated flow.
   b. The valve bodies shall be of cast iron, steel or bronze and rated for 150 PSI working pressure. All internal parts shall be stainless steel, steel, Teflon, brass, or bronze.
   c. DeltaP Valves manufactured by Flow Control Industries, Belimo, Danfoss Series, or approved equal.
   d. The valves shall have pressure taps across the valve for measuring the pressure drop across the valve. The pressure taps shall have ½-inch extensions for accessibility.
   e. Control valves shall be installed with unions or flanges as necessary for easy removal and replacement.
   f. Valve Tag shall include the model number, AHU being served, design flow, and maximum flow for that valve.
   g. The control valves shall be delivered preset to the scheduled design flow and should be capable of reaching 110% of the design flow to allow for field adjustment for capacity changes.

D. Control Dampers: Ruskin CD-50 or approved equal.

1. Provide dampers with parallel blades for 2- position control.
2. Provide opposed blades for modulating control.
3. Dampers shall be low leakage design with blade and edge seals.
4. Provide multiple sections and operators as required by opening size and sequence of operations, as indicated on the contract drawings.

E. Electric Actuators: Johnson Controls, Bray, Belimo, TAC or approved equal. KMC actuators are not approved. Size electric actuators to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or 2-position action as specified. If mixed air AHU has return air, exhaust air and outside air dampers that are not mechanically linked then static safety switch must be installed and wired to safety circuit. Spring return actuators should be provided on heat exchanger control valves or dampers or as specified on the drawings. Control signal shall be 0 to 10 VDC unless otherwise specified on drawings. Actuators with integral damper end switch are acceptable. For VAV reheat valves, actuators shall have a manual override capability to aid in system flushing, startup, and balancing.

F. Air and Hot Water Electronic Temperature Sensors:

1. All electronic temperature sensors shall be compatible with Johnson METASYS systems.
2. Sensors shall be 1,000 ohm platinum, resistance temperature detectors (RTDs) with two wire connections. Duct mounted sensors shall be averaging type. Contractor may install probe type when field conditions prohibit averaging type, but must receive permission from Owner's Representative.
3. Coordinate thermowell manufacturer with RTD manufacturer. Thermowells that are installed by the contractor, but are to have the RTD installed by owner, must be Johnson Controls Inc. series WZ-1000.

G. Electronic Temperature Sensors and Transmitters:

   a. General: The RTD/Temperature Transmitter/Thermowell assembly shall come as a complete assembly from a single manufacturer. The Assembly shall be suitable for use in the accurate measurement of Chilled/Tower/Hot Water and steam temperatures in a mechanical room environment.
   b. Calibration: Each RTD must be match calibrated to the Transmitter via NIST traceable calibration standards. Results are to be programmed into the transmitter. Results are to be presented on report as after condition at the specified calibration points. Assembly shall not be approved for installation until Owner has received all factory calibration reports.
   c. RTD:
      1) RTD type: 2-wire or 3-wire 100 ohm platinum class A
      2) Outside Diameter: 0.25 inch
      3) Tolerance: +/- 0.06% Type A
      4) Stability: +/- 0.1 % over one year.
      5) TCR: 0.00385 (ohm/ohm/° C).
      6) RTD shall be tip sensitive.
      7) Resistance vs. Temperature table for the RTD must be provided to the Owner.
   d. Transmitter:
1) Transmitter shall be match calibrated to the RTD and assembled as a matched pair.
2) Type: 2 wire (loop powered)
3) Input: 2 or 3 wire 100 ohm platinum class A or class B RTD
4) Output: Output shall be a 4-20 mA signal linear to temperature
5) Calibrated Span:
   a) Chilled Water: 30° F. to 130° F.
   b) Tower Water: 30° F. to 130° F.
   c) Hot Water: 100° F. to 250° F.
   d) Steam: 150° F. to 450° F.
6) Calibration Accuracy, including total of all errors, of the Transmitter & RTD matched pair over the entire span shall be within +/- 0.2% of the calibrated span or +/- 0.18° F, whichever is greater.
7) Supply Voltage: 24 VDC.
8) Ambient Operating Temp.: 32 to 122° F.
9) Epoxy potted for moisture resistance.
10) Mounting: Transmitter shall be mounted in the RTD connection head.

e. Thermowell:
   1) Thermowell shall be suitable for immersion in chilled/hot water and steam.
   2) Thermowell shall be reduced tip.
   3) Thermowell shall be one piece stainless steel machined from solid bar stock.
   4) Thermowell shall have 1/2” NPT process connection to pipe thread-o-let.
   5) Thermowell Insertion depth shall be ½ the inside pipe diameter but not to exceed 10”.

f. Assembly:
   1) Assembly configuration: Spring loaded RTD with thermowell-double ended hex-connection head.
   2) Connection head shall be cast aluminum with chain connecting cap to body, have 1/2” NPT process and 3/4” NPT conduit connections, and a sealing gasket between cap and body.

g. RTD/Temperature Transmitter/Thermowell assembly shall be the following or approved equal:
   1) Manufacturer: Pyromation, Inc.
   2) Chilled Water: RAF185L-S4C[length code]08-SL-8HN31,TT440-385U-S(30-130)F with calibration SMC(40,60)F
   3) Tower Water: RAF185L-S4C[length code]08-SL-8HN31,TT440-385U-S(5130)F with calibration SMC(55,85)F
   4) Hot Water: RAF185L-S4C[length code]08T2-SL-8HN31,TT440-385U-S(100-250)F with calibration SMC(140,180)F
   5) Steam: RAT185H-S4C[length code]08T2-SL-8HN31,TT440-385U-S(150-450)F with calibration SMC(300,350)F
H. Occupant Override: Provide wall mounted occupant override button in locations shown on drawings.

I. Low Limit Controllers: Provide unit-mounted low limit controllers, of rod-and-tube type, with an adjustable set point and a manual reset. Capillary shall be of adequate length to horizontally traverse face of cooling coil every 12”. Multiple low limit controllers may be required for large coils. Controller shall have an extra set of contactors for connection to control panel for alarm status. Locate the thermostat case and bellows where the ambient temperature is always warmer than the set point.

1. Freeze Stats: Johnson Controls model A70HA-1 or approved equal.

J. Humidistats: Humidistats must be contamination resistant, capable of ±2% RH accuracy, have field adjustable calibration and provide a linear proportional signal.

1. HD20K-T91 or equivalent.

K. Humidity High Limit

1. Multi-function device that can function as a high limit or proportional override humidity controller, as stand-alone proportional controller, or a stand-alone two-position controller.

   a. Johnson Controls TRUERH HL-67N5-8N00P or approved equal.

L. Carbon Dioxide Sensor:

1. Wall Mount: ACI Model ESENSE-R.
2. Duct Mount: ACI Model ESENSE-D.

M. Fan/Pump Status: Status points for fan or pump motors with a VFD must be connected to the terminal strip of the VFD for status indication. Current switches: Current switches are required for fan and pump statuses that are not connected to a VFD. The switches must have an adjustable trip setpoint with LED indication and be capable of detecting broken belts or couplings. Units shall be powered by monitored line, UL listed and CE certified, and have a five year warranty.

1. Kele, Hawkeye or approved equal.

N. Relays Used for Fan and Pump Start/Stop: Must have LED indication and be mounted externally of starter enclosure or VFD.

1. Kele, RIBU1C or approved equal.

O. Power Supply Used to Provide Power to Contractor-Provided Control Devices: Shall have adjustable DC output, screw terminals, overload protection and 24 VAC and 24 VDC output.

1. Kele, DCPA-1.2 or approved equal.

P. Pressure Differential Switch:

1. Fans: NECC model DP222 or approved equal.
Q. Differential Pressure Transmitter: Provide units with linear analog 4-20mA output proportional to differential pressure, compatible with the Johnson METASYS Systems.

1. Water: Units shall be wet/wet differential pressure capable of a bi-directional pressure range of +/- 50 psid. Accuracy shall be +/- 0.25% full scale with a compensated temperature range of 30 to 150 deg F and a maximum working pressure of 250 psig.
2. Install transmitter in a pre-manufactured assembly with shut off valves, vent valves and a bypass valve.
3. a) Setra model 230 with Kele model 3-VLV, three valve manifold or approved equal.
4. Air: Units shall be capable of measuring a differential pressure of 0 to 5 in. WC. Accuracy shall be +/- 1.0% full scale with a compensated temperature range of 40 to 149 deg F and a maximum working pressure of 250 psig.
   a. Setra model 267, or approved equal.
   b. Shall be installed in control panel and piped 2/3 down the duct unless shown otherwise or approved by owners representative.

R. Building Static Pressure: Transducer shall utilize a ceramic capacitive sensing element to provide a stable linear output over the specified range of building static pressure. Transducer shall be housed in a wall-mounted enclosure with LCD display. Transducer shall have the following capabilities:

1. Input Power: 24 VAC
2. Output: 0-10 VDC
3. Pressure Range: -0.25 to +0.25 inches w.g.
4. Display: 3-1/2 digit LCD, displaying pressure in inches w.g.
5. Accuracy: +/- 1.0% combined linearity and hysteresis
6. Temperature effect: 0.05% / deg C
7. Zero drift (1 year): 2.0% max
8. Zero adjust: Push-button auto-zero and digital input
9. Operating Environment: 0 to 140 deg F, 90% RH (non-condensing)
10. Fittings: Brass barbs, 1/8” O.D.
11. Enclosure: High-impact ABS plastic
12. Outside Air Sensor Pickup Port: UV stabilized thermoplastic or aluminum “can” enclosure to shield outdoor pressure sensing tube from wind effects. BAPI ZPS-ACC10-rooftop mount, wall mount, or equivalent.
13. Transducer shall be Veris Industries Model PXPLX01S, equivalent from Setra, or approved equal.

S. High Static Pressure Limit Switch: Provide pressure high limit switch to open contact in fan circuit to shut down the supply fan when the inlet static pressure rises above the set point. Provide with an adjustable set point, a manual reset button, 2 SPST (normally closed) contacts, and ¼” compression fittings.

1. Kele model AFS-460-DDS, or approved equal.

T. AIRFLOW/TEMPERATURE MEASUREMENT DEVICES
1. Provide airflow/temperature measurement devices where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.

2. The measurement device shall consist of one or more sensor probe assemblies and a single, remotely mounted, microprocessor-based transmitter. Each sensor probe assembly shall contain one or more independently wired sensor housings. The airflow and temperature readings calculated for each sensor housing shall be equally weighted and averaged by the transmitter prior to output. Pitot tubes and arrays are not acceptable. Vortex shedding flow meters are not acceptable.

3. All Sensor Probe Assemblies
   a. Each sensor housing shall be manufactured of a U.L. listed engineered thermoplastic.
   b. Each sensor housing shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine airflow rate and ambient temperature. Devices that use “chip” or diode case type thermistors are unacceptable. Devices that do not have 2 thermistors in each sensor housing are not acceptable.
   c. Each sensor housing shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range. Each sensor housing shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
      1) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
   d. The operating temperature range for the sensor probe assembly shall be -20° F to 160 F. The operating humidity range for the sensor probe assembly shall be 0-99% RH (non-condensing).
   e. Each temperature sensor shall be calibrated at a minimum of 3 temperatures and have an accuracy of +/-0.15° F over the entire operating temperature range. Each temperature sensor shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
   f. Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
   g. Each sensor assembly shall not require matching to the transmitter in the field.
   h. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location.

4. Duct and Plenum Sensor Probe Assemblies
   a. Sensor housings shall be mounted in an extruded, gold anodized, 6063 aluminum tube probe assembly. Thermistor probes shall be mounted in sensor housings using a waterproof marine grade epoxy resin. All wires within the aluminum tube shall be Kynar coated.
   b. The number of sensor housings provided for each location shall be as follows:
      1) Area (sq.ft.) Sensors
         <2 4
c. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
   1) Insertion mounted through the side or top of the duct.
   2) Internally mounted inside the duct or plenum.
   3) Standoff mounted inside the plenum.

d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

5. Fan Inlet Sensor Probe Assemblies
   a. Sensor housings shall be mounted on 304 stainless steel blocks.
   b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
   c. Mounting feet shall be constructed of 304 stainless steel.
   d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.

6. Transmitters
   a. The transmitter shall have a 16 character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics. Configuration settings and diagnostics shall be accessed through a pushbutton interface on the main circuit board. Airflow shall be field configurable to be displayed as a velocity or a volumetric rate.
   b. The transmitter shall be capable of independently monitoring and averaging up to 16 individual airflow and temperature readings. The transmitter shall be capable of displaying the airflow and temperature readings of individual sensors on the LCD display.
   c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required). The transmitter shall use a switching power supply fused and protected from transients and power surges.
   d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.
   e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be protected from weather and water.
   f. The transmitter shall be capable of communicating with the host controls using one of the following interface options:
      1) Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire).
      2) RS-485: Field selectable BACnet-MS/TP, ModBus-RTU and Johnson Controls N2 Bus.
      3) 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, ModBus-TCP and TCP/IP.
4) LonWorks Free Topology.

g. The transmitter shall have an infra-red interface capable of downloading individual sensor airflow and temperature data or uploading transmitter configuration data to a handheld PDA (Palm or Microsoft Pocket PC operating systems).

7. The measuring device shall be UL listed as an entire assembly.

8. The manufacturer’s authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer’s placement requirements.

9. Manufacturer

a. Primary flow elements, sensors, meters and transducers shall be EBTRON, Inc. Model GTx116-P and GTx116-F or approved equal.

b. The naming of any manufacturer does not automatically constitute acceptance of this standard product nor waive their responsibility to comply totally with all requirements of the proceeding specification.

U. Electrical Requirements: Provide electric-pneumatic switches, electrical devices, and relays that are UL-listed and of type which meet current and voltage characteristics of the project. All devices shall be of industrial/commercial grade or better. Residential types will be rejected.

1. EP Switches: Landis & Gyr Powers, Inc. Series 265 - Junction Box Type or approved equal.

2. Relays: Relays shall have an LED status indicator, voltage transient suppression, Closed-Open-Auto switch, plastic enclosure, and color coded wires. Kele model RIBU1C or approved equal.

V. Magnetic Flowmeter for Chilled Water, Tower Water, Make Up Water:

1. The Magnetic Flowmeter flow tube and computer/transducer shall come as a complete system assembled by a single manufacturer. The flowmeter shall be suitable for use in the accurate measurement of Chilled Water flow, Cooling Tower Water flow, or Make Up water flow for process control and/or utility metering, in a mechanical room environment, with a Johnson Controls EMCS system.

2. The flowmeter shall consist of a pulsed DC electromagnetic coil incorporating Faraday’s Law utilizing the flowing Water as the conductor. The flowmeter shall provide proper grounding for use in Schedule 40 steel pipe, Schedule 10S stainless steel pipe, or copper pipe as application requires.

3. The flowmeter element should be sized to maintain maximum accuracy over the flow range of the application while keeping flow tube velocity below 15 fps at max flow. The flowmeter element shall be the flow tube, spool piece type with a non-conductive lining and no intrusions into the flow path. The flowmeter flow tube shall be suitable for direct mounting to standard ANSI flanges.

4. The flowmeter shall have a local LCD display that indicates flow in GPM and/or Total gallons from the totalizer. The flowmeter shall be programmable/configurable via local push buttons. The flowmeter computer/transducer shall be remote mounted. The flow tube shall have a direct mounted junction box for wiring connections.

5. The flowmeter shall have the capability to be calibrated insitu to verify proper operation and accuracies.
6. The flowmeter shall also meet the following specifications:

a. Measures Bi-directional flow.
b. Zero-point stability.
c. Flow tube can withstand a full vacuum on an intermittent basis.
d. Normal obstructions, partially opened valves, 900 or 450 elbows, and pump discharges shall require no more than 5 pipe diameters upstream and 3 pipe diameters downstream of straight pipe run for specified performance.
e. Auto re-start after electrodes have lost wetness.
f. Computer/transducers shall be interchangeable to multiple flow tubes without affecting the published accuracies of the meter.
g. Computer/transducer internal electronic components, including power supply and output boards, shall be field interchangeable/exchangeable.
h. Calibration: NIST Traceable, certificate provided with each meter.
i. Electrode Pressure Rating: Equivalent to flow tube flange rating
j. Minimum Conductivity: 5 mS/cm for fluid to be measured
k. Transmitter Ambient Temp.: 122° F.
l. Flow Tube Process Temp.: 32° F. to 140° F. for Chilled Water applications
m. Flow Tube Process Temp.: 32° F. to 140° F. for Make Up Water applications
n. Flow Tube Process Temp.: 32° F. to 311° F. for Hot or Dual Water applications
o. Flow Range: +/- 0 to 30 fps
p. Accuracy (velocity < = 1.0 fps): +/- 0.5% of reading or +/- 0.005 fps
q. Accuracy (velocity > 1.0 fps): +/- 0.5% of reading
r. Analog Output: 4-20 mA, linear to flow in GPM
s. Analog Output Accuracy: +/- 0.05% of span
t. Repeatability: +/- 0.1%
u. Stability: +/- 0.1%
v. Ambient Temperature Effect: <1% per 100 0F
w. Vibration Effect: 0.1% (remote mounted transducer)
x. Low Flow Cutoff: settable to 0.04 fps or lower
y. Low Flow Cutoff Analog Output: Analog output shall be 4.0 mA at flows below the low cutoff.
z. Humidity Limits: 5-90% RH
aa. Power Supply: 115 VAC
bb. Power Consumption: 20 W maximum
cc. Enclosures: NEMA 4
dd. Flow Tube working pressure: 150 psi
ee. Flanges: Carbon steel, ANSI Class 150#
ff. Electrodes: Corrosion resistant Alloy C
gg. Cable Length: As required per plans, 150 ft minimum
hh. Cable shall be capable of empty pipe detection.
ii. All cable shall be provided by the meter manufacturer.

7. The flowmeter shall be Foxboro IMT31A with 9500A, 9700A for high temperature, or approved equal.

8. Bids/Submittals: All bids and/or submittals must include published specifications, specific model number configurations, and operation & maintenance manuals.

9. Warranty: All parts and components as needed for the specified operation and performance shall be covered under warranty for a period of not less than two years.
W. Ultrasonic Level Transmitter for Cooling Tower Basin Water: Furnish and install, where indicated on plans, a device for measuring the tower basin water level. The level transmitter shall meet the following specifications:

1. Make: Flowline
2. Model: EchoSpan LU83-51-01
3. Range: 8” to 26.2 feet
4. Accuracy: 0.2% of span in air
5. Resolution: 0.039”
6. Beam width: 3”
7. Dead band: 8”
8. Display type: 6 digit LCD
9. Display units: Inch, cm, %
10. Memory: Non-volatile
11. Supply voltage: 12-28 VDC
12. Loop resistance: 500 Ohms @ 24 VDC
13. Signal output: 4-20 mA two-wire
14. Signal invert: 4-20 mA or 20-4 mA
15. Calibration: Push button
16. Fail-safety: Selectable 4 mA, 20 mA, 21 mA, 22 mA, or hold
17. Process temperature: -4° F. to 140° F.
18. Temp. Comp.: Automatic
19. Electronics temp.: -40° F. to 160° F.
20. Pressure: 30 psi @ 25° C, derated @ 1.667 psi/°C above 25° C.
21. Enclosure rating: NEMA 4X (IP65)
22. Enclosure vent: Water tight membrane
23. Enclosure material: PC/ABS FR
24. Trans. Material: PVDF
25. Process mount: 2” NPT
26. Mounting gasket: Viton
27. Conduit entrance: Dual, ½” NPT
28. Classification: General purpose
29. CE compliance: EN 61326 EMC
30. Level transmitter shall be Flowline EchoSpan LU83-51-01 or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer’s instructions, roughing-in drawings and details shown on drawings.

B. Control Air Piping:

1. All control air piping shall be copper. Exception: Flexible Tubing may be used for a maximum of two (2) feet at connections to equipment [except for steam control valves] and inside control cabinets.
2. Provide copper tubing with a maximum unsupported length of 3'-0".
3. Pressure Test control air piping at 30 psi for 24 hours. Test fails if more than 5 PSI loss occurs.
4. Fasten flexible connections bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support tubing neatly.
5. Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system.
6. All control tubing at control panel shall be tagged and labeled during installation to assist owner in making termination connections at control panel.
7. Provide pressure gages on each output device.
8. Paint all exposed control tubing to match existing.

C. Raceway: Raceway is to be installed in accordance with the National Electric Code. Use of flexible metal conduit or liquidtight flexible conduit is limited to 36" to connect from EMT to devices subject to movement. Flexible raceway is not to be used to compensate for misalignment of raceway during installation.

D. Control Wiring: Install control wiring in raceway, without splices between terminal points, color-coded. Install in a neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.

1. Install circuits over 25-volt with color-coded No. 12 stranded wire.
2. Install electronic circuits and circuits under 25-volts with color-coded No. 18 stranded twisted shielded pair type conductor.
3. N2 communications bus wire shall be 18 AWG, plenum rated, stranded twisted shielded, 3 conductor, with blue outer casing, descripted as 18-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
   a. Metastat wiring shall be minimum 20 AWG, plenum rated, stranded, 8 conductor stranded wire.
4. FC communications bus wire shall be 22 AWG, plenum rated, stranded twisted shielded, 3 conductor, with blue outer casing, descripted as 22-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
   a. Network sensor wiring (SA Bus) shall be 22 gauge plenum rated stranded twisted wire, 4 conductor.
5. All control wiring at control panel shall be tagged and labeled during installation to assist owner in making termination connections at control panel. Label all control wires per bid documents.

E. All low voltage electrical wiring shall be run as follows:

1. Route electrical wiring in concealed spaces and mechanical rooms whenever possible.
2. Provide EMT conduit and fittings in mechanical rooms and where indicated on drawings.
3. Low voltage electrical wiring routed above acoustical ceiling is not required to be in conduit, but wire must be plenum rated and properly supported to building structure.
4. Provide surface raceway, fittings and boxes in finished areas where wiring cannot be run in concealed spaces. Route on ceiling or along walls as close to ceiling as possible. Run raceway parallel to walls. Diagonal runs are not permitted. Paint raceway and fittings to
match existing conditions. Patch/repair/paint any exposed wall penetrations to match existing conditions.

F. All devices shall be mounted appropriately for the intended service and location.

1. Adjustable thermostats shall be provided with base and covers in occupied areas and mounted 48" above finished floor to the top of the device. Tubing and/or wiring shall be concealed within the wall up to the ceiling where ever possible. Surface raceway may only be used with approval of Owners Representative. Wall mounted sensors such as CO2, RH, and non-adjustable temperature sensors shall be mounted 54” above finished floor. Duct mounted sensors shall be provided with mounting brackets to accommodate insulation. Mounting clips for capillary tubes for averaging sensors are required.

2. All control devices shall be tagged and labeled for future identification and servicing of control system.

3. Preheat and mixed air discharge sensors must be of adequate length and installed with capillary tube horizontally traversing face of coil, covering entire coil every 24 inches bottom to top.

4. All field devices must be accessible or access panels must be installed.

G. Install magnetihec pressure gage across each air handling unit filter bank. If the air handling unit has a prefilter and a final filter, two magnetihec pressure gages are required.

3.2 ADJUSTING AND START-UP

A. Start-Up: Temporary control of Air Handling Units shall be allowed only if approved by the owner’s representative to protect finishes, etc., AHUs may be run using caution with temporary controls installed by contractor early in the startup process. All safeties including a smoke detector for shut down must be operational. Some means of discharge air control shall be utilized and provided by the contractor such as a temporary temperature sensor and controller located and installed by the Contractor.

B. The start-up, testing, and adjusting of pneumatic and digital control systems will be conducted by owner. Once all items are completed by the Contractor for each system, Contractor shall allow time in the construction schedule for owner to complete commissioning of controls before project substantial completion. This task should be included in the original schedule and updated to include the allotted time necessary to complete it. As a minimum, the following items are required to be completed by the Contractor for Owner to begin controls commissioning.

1. Process Control Network
   a. The control boards and enclosures need to be installed in the mechanical rooms.
   b. The fiber optic conduit and box for the process control network needs to be installed. Once in place, Owner needs to be contacted so the length of the owner provided fiber cable can be determined and ordered, if required. Coordinate with Owner to schedule the pull in and termination of the fiber cable. Power should be in place at that time. (Fiber for the process control network is required to allow metering of utilities prior to turn on.)

2. Heating System
a. Pumps, heat exchangers, steam pressure reducing station, piping, control valves, steam and/or hot water meter, feeder conduit and wire, VFDs, control panels and control wiring installed in the mechanical room. The housekeeping pads must be poured before pump operation. All must be in place in working order (pumps aligned, VFDs set up by vendor, motors checked for rotation, steam regulators set to required pressure, condensate pumps operational, heating system ready to circulate (all piping pressure tested, flushed, and insulated) with differential pressure sensors in place.

3. Cooling System
   a. Pumps, heat exchangers, piping, control valves, chilled water meter, feeder conduit and wire, VFDs, control panels and control wiring installed in the mechanical room. The housekeeping pads must be poured before pump operation. All must be in place in working order (pumps aligned, VFDs set up by vendor, motors checked for rotation, cooling system ready to circulate (all piping pressure tested, flushed, and insulated) with differential pressure sensors in place.

4. VAVs-First Pass
   a. Power, (FC or N2 bus), and control wire installed before owner can make first commissioning pass. First pass includes installation of VAV controller, termination of power, control and network communication wiring.

5. Air Handlers
   a. Prior to owner commissioning, at a minimum, the following items shall be complete: Power wiring, motor rotation check, fire/smoke dampers open, control wiring including all safeties, IO cabinet, air handler cleaned, and filters installed as required. To protect the systems from dirt, outside air with no return will be used until the building is clean enough for return air operation.

6. VAVs-Second Pass
   a. After the air handlers are running and under static pressure control and the heating water system is operating, a second pass can be made on the VAVs to download the control program and commission controllers to verify the VAV dampers, thermostat, and reheat control valves are working properly.

7. Exhaust and Energy Recovery Systems
   a. Exhaust fans need to be operational and under control before labs can be commissioned.

8. Lab Air Controls
   a. Lab Air Controls vendor will have the same requirements as stated above for VAVs.

9. Some balance work can be done alongside the control work as long as areas are mostly complete and all diffusers are in place.
3.3 CLOSEOUT PROCEDURES

A. Contractor shall provide complete diagrams of the control system including flow diagrams with each control device labeled, a diagram showing the termination connections, and an explanation of the control sequence. The diagram and sequence shall be framed and protected by glass and mounted next to controller.

B. Contractor shall provide as built diagram of network bus routing listing all devices on bus, once wiring is complete prior to scope completion.

END OF SECTION 230900
SECTION 260519 - BUILDING WIRE & CABLE

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Building wire and cable as shown on drawings or specified including feeders, branch circuit power, lighting systems and other systems specified.
   2. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 260533 - Conduit.
B. Section 260534 - Boxes.
C. Section 260526 - Grounding and Bonding.
D. Section 260553 - Identification.

1.3 REFERENCES


1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years experience.

1.5 SUBMITTALS

A. Submit shop drawings and product data per Division 1.
B. Indicate material specifications, dimensions, capacities and color coding.
C. Provide product data for all wire and cable.
D. Submit manufacturer’s installation instructions.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

1.7 REFERENCES

A. If conflict between referenced standards and contract documents, notify Architect/Engineer immediately. Do not proceed with the work until the Architect/Engineer issues instructions.
B. National Electrical Manufacturers Association (NEMA):
   1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.


D. Manufacturers Catalogs: Specified manufacturers catalogs are incorporated by reference to same force and effect as if repeated herein full.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductors shall be copper.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.9 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Thermoplastic insulated building wire: NEMA WC 5, UL-83 ICEA S-61-402 or S-66-524.

B. Feeders larger than 250 MCM: Copper, stranded conductor, 600 volt insulation XHHW.

C. Feeders and branch circuits larger than 8 AWG and smaller than 250 MCM: Copper, stranded conductor, 600 volt insulation THHN/THWN.

D. Feeders and branch circuits 8 AWG and smaller: Copper conductor, 600 volt insulation THHN/THWN, solid or stranded conductor.

E. Control Circuits: Copper, stranded conductor, 600 volt insulation THW, THHN/THWN.

F. Underground feeders and circuits: Copper, stranded conductor, 600 volt insulation, type XHHW-2.

G. Color code conductors as specified in Section 260553 - Electrical Identification.
2.2 JOINTS AND SPLICES

A. Make terminations, taps and splices with an indent type pressure connector with insulating cover for 8 AWG and smaller.

B. Instead of indent type connectors insulated spring compression connectors may be used for 10 AWG and smaller.

C. Use mechanical compression or bolted type connector for 6 AWG or larger. Cover connector with insulating type or heat shrinkable insulation equivalent to 150% conductor insulation.

2.3 WIRE PULLING LUBRICANT

A. Pulling lubricant shall be NRTL listed, water-based, polymer solution. Lubricants containing waxes or soaps are not acceptable.

B. The lubricant shall be compatible with the cable insulation and shall not cause any premature deterioration of the insulating material.

C. Dried residue from lubricant shall not become tacky or gum-up. Cables shall remain pullable after lubricant has dried.

D. The lubricant shall be approved by the cable manufacturer for use with their cables.

E. Acceptable Manufacturers/Products:

1. American Colloid/Poly-X.
2. American Polywater/Polywater J.
3. ARNCO/Hydra-Lube.
5. Condux/Super-Lube.
6. Ideal/Aqua-Gel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Exposed Dry Interior Locations: Use only building wire, in raceway.

B. Wet or Damp Interior Locations: Use only building wire, in raceway.

C. Exterior Locations: Use only building wire, in raceway.
D. Underground Installations: Use only building wire, in raceway.
E. Use wiring methods indicated on Drawings.

3.4 INSTALLATION
A. Install products in accordance with manufacturer’s instructions.
B. Use conductor not smaller than 12 AWG for power and lighting circuits.
C. Use conductor not smaller than 14 AWG for control circuits.
D. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 140 feet.
E. Pull all conductors into raceway at same time.
F. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
G. Protect exposed cable from damage.
H. Use suitable cable fittings and connectors.
I. Neatly train and lace wiring inside boxes, equipment, panelboards and switchboards.
J. Clean conductor surfaces before installing lugs and connectors.
K. Make splices, taps and terminations to carry full ampacity of conductors with no perceivable temperature rise.
L. Place an equal number of conductors for each phase of a circuit in same raceway or cable.
M. Splice only in accessible junction, outlet boxes, cable tray or surface metal raceway.
N. Make conductor lengths for parallel circuits equal.
O. Provide dedicated neutral conductor for each computer lab circuit.

3.5 IDENTIFICATION
A. Identify wire and cable under provisions of Section 260553.
B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.6 FIELD QUALITY CONTROL
A. Inspect wire and cable for physical damage and proper connection.
B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
C. Verify continuity of each branch circuit conductor.

END OF SECTION 260519
SECTION 260526 - GROUNDING & BONDING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Power system grounding for services.
   2. Grounding for separately derived systems.
   3. Grounding for control circuitry.

1.2 RELATED SECTIONS

A. Section 260533 - Conduit.
B. Section 260519 - Building Wire and Cable.
C. Section 266100 - Testing

1.3 DEFINITIONS

A. Equipment Ground Conductor:
   1. The conductor that connects the non-current-carrying metal parts of equipment to the
      grounding electrode system or ground bus.

B. Grounding Electrode Conductor:
   1. The conductor that connects the ground electrodes to the grounded circuit conductor
      and/or the equipment grounding conductor.

C. Grounded Circuit Conductor:
   1. A circuit conductor, usually the neutral that is intentionally connected to ground.

D. Isolated Ground:
   1. A conductor or system that connects equipment directly to the ground electrodes.
      Also referred to as a single point ground.

E. Made Electrode:
   1. Any item, such as a ground rod, which is solely used to provide a ground connection.

1.4 REFERENCES

A. National Fire Protection Association (NFPA): NFPA 70 - National electrical Code (NEC)

B. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by
   reference to same force and effect as if repeated herein in full.
1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Submit Product Data: Provide data for grounding electrodes and connections.

C. Submit Test Reports: Indicate overall resistance to ground in accordance with section 266100.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Connections:

1. All rod to rod, rod to cable, cable to cable, and cable to structural steel connections shall be by an approved exothermic or mechanical weld process.

2. Any splices to ground electrode conductors shall be exothermic weld only.

3. Any bonding to gas piping (service entrance and corrugated stainless steel tubing) shall be by an approved bonding clamp.

B. Terminating Lugs:

1. Exothermic weld, mechanical weld, or crimp compression type.

C. Wire:

1. Equipment grounding conductors shall be insulated. Insulation shall be 600 volt, same type as phase conductors, green in color. Use yellow tracer stripes to distinguish different grounding systems.

2. Ground electrode conductors shall be bare annealed copper.

D. Rod Electrode:

1. Material: Copper-Clad Steel.


3. Length: 10 feet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a separate equipment grounding conductor in all feeders and branch circuits. Terminate each end on grounding lug, bus or busing.

B. Size all grounding conductors to handle all available fault currents safely.

C. Bond all raceways, cabinet enclosures, and non-current-carrying parts of equipment to grounding system. Bond raceways such that a continuous path for current flow is
maintained.

D. **Bond all grounding systems together.** *Size of bonding conductor shall be at least the size of the largest grounding electrode conductor.*

E. Ground electrode conductors shall be run exposed whenever possible. If conduit is needed for protection, Schedule 40 conduit shall be used. All cable clamps and conduit supports shall be designed so they do NOT totally encircle conduit or cable in metal.

F. All connections to structural steel shall be by the exothermic weld process.

3.2 **FIELD QUALITY CONTROL**

A. Field inspection and testing will be performed under provisions of section 266100.

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

C. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

D. Resistance measurement shall be from the system neutral connection at the service entrance to a convenient ground reference point. The ground reference point should be located to minimize the effects of other existing grounding electrodes.

E. Ground resistance shall not exceed 10 OHMS. When resistance exceeds 10 OHMS, one of the following measures shall be taken to reduce the ground resistance:

1. Drive and bond additional ground rods at two rod length intervals.
2. Treat the soil in the vicinity of the electrode with metallic salts.
3. Remove soil from around the electrode and replace with bentonite.
4. Use a UL approved electrolytic chemical ground rod.

F. All resistance tests shall be taken no sooner than 48 hours after a measurable rainfall.

END OF SECTION 260526
SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Conduit and equipment supports.
   2. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Contractors Association.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.
B. Product Data: Provide manufacturer's catalog data for fastening systems.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.
B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
C. Anchors and Fasteners:
   1. Concrete Structural Elements: Use expansion anchors and preset inserts.
   2. Steel Structural Elements: Use beam clamps, steel ramset fasteners and welded fasteners.
   5. Solid Masonry Walls: Use expansion anchors and preset inserts.

D. Steel Channel

1. Description: Galvanized, Huskey HP-200, Kindorf B-901, Unistrut P-1000 or B-Line B22. Combine channels to provide adequate strength and stability to support equipment as indicated on plans and approved by the Architect/Engineer. Steel channel shall be sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

C. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/4-inch and smaller raceways serving lighting, receptacle, and communications circuits above suspended ceilings and concealed within walls. However, spring-steel fasteners (beam, purlin, wire, rod, etc.) designed for friction-fit attachment are not acceptable. Fasteners must use a minimum of one mechanical (set screw, bolt and clamp) element for attachment.

D. Do not use powder-actuated anchors.

E. Do not drill or cut structural members.

F. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

G. Install surface-mounted cabinets and panel boards with minimum of four anchors.

H. In wet and damp locations use steel channel supports to stand cabinets and panel boards one inch off wall.

I. Use sheet metal channel to bridge studs above and below cabinets and panel boards recessed in hollow partitions.

J. Touch-up any material damaged during construction.

K. Provide support to meet seismic requirements. Where necessary provide the services of a registered structural engineer to calculate and engineer support systems or restraints. Submit to Architect/Engineer results and documents (sealed drawings) for any such systems or restraints.
SECTION 260533 - CONDUIT

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:

1. Metal conduit.
2. Nonmetal conduit.
3. Fittings and conduit bodies.
4. Tracer Tape
5. Fire seal of all conduits passing through fire partitions.
6. Moisture seal of all conduits passing through exterior walls, floor slab, and roof.

1.2 RELATED SECTIONS

A. Section 260534 – Boxes.
B. Section 260526 – Grounding and Bonding.
C. Section 260529 – Supporting Devices.
D. Section 260553 – Electrical Identification.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
C. ANSI C80.5 - Rigid Aluminum Conduit.
D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
F. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
H. NEMA TC 13 – Electrical Non Metallic Tubing.

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.5 SUBMITTALS
A. Submittals for approval by the engineer are not required for this section except as indicated below. Un-requested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits 2” and larger.
B. Accurately record all conduit serving parking lot lighting, landscape lighting, building façade lighting and sign lighting.
C. Accurately record all service conduits feeding to and from the Utility transformer.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.
B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
C. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.
B. Verify routing and termination locations of conduit prior to rough-in.
C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch unless otherwise specified.
B. Underground Installations:
   1. More than Five (5) Feet from Foundation Wall: Use thick wall nonmetallic conduit.
   2. Within Five (5) Feet from Foundation Wall: Use rigid steel conduit.
   3. Under Slab on Grade: Use thick wall nonmetallic conduit.
   4. Minimum Size: 1 inch unless otherwise specified.
5. Provide red tracer tape 12” above conduit on all exterior underground installations.

C. Outdoor Locations, Above Grade: Use rigid steel conduit.

D. Wet and Damp Locations Above Grade: Use rigid steel conduit.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron.

2.3 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.4 SEALING

A. Fire Seal

1. Seal penetrations of fire-rated walls, floors or ceilings by raceways for compliance with NEC 300-21. Fill void around raceway. Use heavy wall steel pipe sleeves, anchored to building construction and finished plumb with wall ceiling or floor lines. Acceptable products:

   a. Spec-Seal – SSS
   b. T & B – Flamesafe
   c. 3M - Fire Barrier

2. Smoke and fire stop fittings may be used in lieu of sealant. Acceptable products:

   a. OZ-Gedney, series CFS

B. Water Seal

1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and approved by Architect/Engineer. Use pre-manufactured fittings.

2.5 SUPPORTING DEVICES

A. Suspended conduits less than 1 inch.

1. For exposed construction, provide strap type hangers supported from beam clamps or threaded rods. Hangers manufactured by Minerallac, Midwest Electric, Crouse-Hinds, T & B or B-Line are acceptable.
2. For conduits suspended above ceilings, anchor to building structural steel. When span exceeds NEC limits, provide channel steel between framing members. Tie wiring of conduit to air ducts, structural steel, piping or other elements not permitted. Plumber’s perforated strap not permitted. Do not attach conduit to ceiling support wires.

B. Suspended Conduit 1 inch or larger
   1. Provide threaded rod with U-type hangers for single conduit.
   2. Provide trapeze hanger assemblies with Unistrut, Husky, Kindorf or B-Line strut and threaded rod for two or more conduits. Anchor conduits to hanger assembly with split pipe clamps.
   3. Anchor threaded rod to inserts in concrete or beam clamps on steel structure.

C. Surface Mounted Conduit
   1. Provide one-hole galvanized steel straps for conduits one inch or less manufactured by Appleton, Steel City, B-Line or Raco. Provide clamp backs on exterior walls below grade or in wet areas.
   2. For conduit larger than one inch and all exterior surfaces, use galvanized, malleable iron pipe straps.
   3. For multiple conduits, provide channel anchored to wall with conduit attached to channel with split pipe clamps. Provide space for 25% additional conduits.

2.6 TRACER TAPE

   A. Size: 3”
   B. Color: Red
   C. Labeling: Shall read “CAUTION BURIED ELECTRIC LINE BELOW”.
   D. The tape shall be of good manufacturing quality in terms of appearance. It shall not gap or telescope more than 0.1 inches when stored at temperatures below 49°C. It must be flexible or not be stiff or brittle in applications ranging from below 0°C to about 38°C. The tape must be removable from the roll without difficulty. The tape shall be smooth, uniform, and free of defects and irregularities. The print shall be uniform, free of visibly large voids and foreign materials, and the lettering free of lumps. The warning words shall be legible, correctly spelled and fully printed. The ink shall be dry, firmly bonded to the substrate, and not transferable to non-printed parts of the film.

PART 3 - EXECUTION

3.1 INTERFERENCES
   A. Coordinate work with other contractors so that interference between piping, equipment, structural and electrical work will be avoided.
   B. If interference develops, Architect/Engineer will decide which equipment will be relocated;
regardless of which apparatus was installed first.

3.2 INSTALLATION

A. Install all conduit routed below floor within rock base of slab. No conduit shall be run in the slab.

B. Install nonmetallic conduit in accordance with manufacturer's instructions. Nonmetallic conduits, fittings and accessories shall be of same manufacturer.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 260529. Supports shall meet seismic requirements.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit under slab from point-to-point.

M. Maintain adequate clearance between conduit and piping.

N. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

O. Cut conduit square using saw or pipe-cutter; de-burr cut ends.

P. Bring conduit to shoulder of fittings; fasten securely.

Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

R. Use conduit hubs or sealing lock nuts to fasten conduit to sheet metal boxes in damp and wet locations.

S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch size.
T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

V. Provide suitable pull-string in each empty conduit except sleeves and nipples.

W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Ground and bond conduit under provisions of Section 260526.

Y. Identify conduit under provisions of Section 260553.

Z. For conduits larger than 1", a Rigid Steel Conduit elbow will be required when penetrating the floor slab. For 1" and smaller PVC elbows will be allowable.

AA. Provide red tracer tape 12" above conduit on all exterior underground installations.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for ductwork or through suitable roof jack with pitch pocket.

C. Install conduits to preserve moisture barriers of partitions and other elements.

END OF SECTION 260533
SECTION 260534 - BOXES

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

1.2 RELATED SECTIONS

A. Section 262726 – Wiring Devices: Mounting heights of wiring device outlets.

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.
B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.
B. Coordinate the quantities and locations of ceiling access panels with the general contractor to provide access to boxes above ceilings in accordance with the National Electrical Code.
C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include allowance of
conduit, wire, hangers, etc to facilitate an installation within 15 feet of location indicated.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 2 inch male fixture studs where required.
   2. Receptacle and outlet box shall be minimum 4 inches square, 1 ½ inches deep. Provide with single or gang cover as needed.
   3. Boxes for telecommunications equipment shall be minimum 4 inches square, 1 ½ inches deep, unless noted otherwise on drawings. Provide with single gang cover as needed.
   4. Boxes for fire alarm devices shall be deep boxes (2-1/8” minimum). Provide with single or gang cover as needed.
   5. Boxes in masonry walls shall be square cut corner, non-ganged type deep masonry boxes.

B. Cast Boxes: NEMA FB 1, Type FD, cast aluminum or cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.2 PULL AND JUNCTION BOXES

A. Interior Dry Locations
   1. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
   2. Size pull or junction boxes to comply with NEC.

B. Interior Wet Locations
   1. Surface-Mounted Cast Metal Box: NEMA 250, Type 4 and 6; flat-flange, surface-mounted junction box.
      a. Material: Galvanized cast iron.
      b. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Exterior Locations
   1. Polymer concrete with reinforced heavy-weave fiberglass with neoprene gasket and cover and stainless steel tamper proof hardware.
   2. Label cover with service provided. (i.e.: “Power” or “Communications”)
   3. Boxes located in vehicular traffic areas to have 15,000 lb rated lids.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install electrical boxes as shown on Drawings. Provide boxes as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Support boxes independently of conduit.

D. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
   1. Interior Dry Locations: Use hinged enclosure under provisions of Section 260535.
   2. Exterior Locations above grade:
      a. Exterior buried electrical vaults shall have a minimum of 18 inches of clean 3/4” gravel below the box to facilitate drainage.
      b. Use surface-mounted hot dip galvanized NEMA 3R.

3.2 COORDINATION

A. Coordinate mounting heights and locations of outlets.

3.3 ADJUSTING

A. Install oil-tight knockout closure in each unused box opening.

END OF SECTION 260534
SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Nameplates and labels.
   2. Wire and cable markers.
   3. Conduit markers.

1.2 RELATED SECTIONS

A. Division 1 – Submittal Procedures.

1.3 REFERENCES

B. ANSI A13.1 - Identification of Piping Systems
C. Local Rules and Regulations.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.
B. Provide catalog data for nameplates, labels, and markers.
C. Submit manufacturer's installation instruction.
D. Submit list of wording, symbols, letter size and color coding for each piece of equipment specified.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:
   1. Switchboards and Panelboards.
   2. Each electrical distribution and control equipment enclosure.
   3. Transformers
   5. Individual switches in distribution gear.
   6. Disconnect switches.
   7. Enclosed circuit breakers.
C. Size of plate shall be commensurate with lettering thereon.

D. Lettering for major items of equipment, such as a panelboard, shall be 1/2" in height. Lettering for smaller items, such as switches, shall be 1/4" in height.

E. Wording on plate shall contain the following information as appropriate.

1. Drawing nomenclature, such as “Panel LP1”.
2. Voltage, i.e. “480/277V” or “208/120V”.
3. Panel fed from (Does not apply to individual switches in distribution gear), i.e. “FED FROM LDP1”.

2.2 WIRE MARKERS

A. Description: Tape or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

C. Legend:

1. Power and Lighting Circuits (including Special Outlets): Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.
3. Wire Insulation Color:

<table>
<thead>
<tr>
<th>Conductor</th>
<th>120/208V, 3 Phase</th>
</tr>
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<tbody>
<tr>
<td>Phase A</td>
<td>Black</td>
</tr>
<tr>
<td>Phase B</td>
<td>Red</td>
</tr>
<tr>
<td>Phase C</td>
<td>Blue</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

2.3 JUNCTION AND PULLBOXES

A. In addition to painting specified in other sections, all junction or pull-boxes shall be clearly marked on the cover identifying the source, circuit and/or functional use.

B. Identification shall be by indelible marker.

2.4 WIRING DEVICE COVERPLATES

A. The panel name and circuit number serving the wiring device shall be clearly written with indelible marker on the back of each coverplate.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.
3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws or adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION 260553
SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor shall provide:

  1. Receptacles.

1.2 RELATED SECTIONS

A. Division 1 – Submittal Procedures.

B. Section 260534 - Boxes.

1.3 REFERENCES

A. NEMA WD 1 - General Requirements for Wiring Devices.

B. NEMA WD 6 - Wiring Device -- Dimensional Requirements.


1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Submit manufacturer's installation instructions.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 3 years experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Duplex Receptacle
1. Hubbell.
2. Leviton.
3. P&S
4. Arrow Hart

B. Description: NEMA WD 1; industrial specification grade general-use receptacle. If using stranded conductor provide device suitable for that use.

1. Color: General Purpose – Ivory
2. Ratings:
   a. NEMA Type 5-20R
   c. Overload: Minimum 4.8 times rated current for 100 cycles.
   d. Temperature Rise: 30 Deg. C maximum at rated current after 50 cycles of overload at 150% of rated current with direct current.
   e. Voltage: 250 volts, AC.
   g. Provide explosion-proof, Class 1, Division 1, receptacle as noted for Finishing 105.

C. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2. Ratings:
   b. Overload: Minimum 4.8 times rated current for 100 cycles.
   c. Temperature Rise: 30 Deg. C maximum at rated current after 50 cycles of overload at 150% of rated current with direct current.
   d. Voltage: 250 volts, AC.
   e. Current Interrupting: Certified for current interrupting at full rated current, 20 amperes.
   f. Provide explosion-proof, Class 1, Division 1, receptacle as noted for Finishing 105.

D. Weatherproof Cover Plate: Weatherproof In-Use Cover: Polycarbonate or impact resistant thermoplastic covers with stainless steel springs. Gray in color. Cover shall be listed as weatherproof with plug inserted into the receptacle. Cover shall be lockable by padlock. Provide for each exterior receptacle and as indicated on the plans. Cover shall be configured for horizontal mounting of receptacle. Acceptable Manufacturers:

1. Cooper Wiring Devices
2. Leviton
3. P&S
4. Raco
PART 3 - EXECUTION

3.1 EXAMINATION
   A. Verify that outlet boxes are installed at proper height.
   B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
   C. Verify that boxes are adjusted properly.
   D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION
   A. Provide extension rings to bring outlet boxes flush with finished surface.
   B. Clean debris from outlet boxes.

3.3 INSTALLATION
   A. Install devices plumb and level.
   B. Install receptacles with grounding pole on bottom.
   C. Connect wiring device grounding terminal to branch circuit equipment grounding conductor per NEC.
   D. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
   E. Connect wiring devices by wrapping conductor around screw terminal.
   F. Use jumbo size plates for outlets installed in masonry walls.
   G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
   H. Install hinged cover and flanges on concealed service floor boxes.
   I. Ceiling mounted receptacles shall be mounted within the ceiling pad. No receptacles are to be installed above the ceiling. Provide a 10 foot flexible conduit from the junction box to the device to allow for relocation.
   J. Clearly write the panel name and circuit number serving each wiring device with indelible marker on the back of each coverplate.

3.4 COORDINATION
   A. Coordinate locations of outlet boxes provided under Section 260534 to obtain mounting heights specified and indicated on drawings.
B. Coordinate location of outlet with furniture layouts.

C. Install wall switch at 48 inches above finished floor.

D. Install convenience receptacle 18 inches above finished floor unless indicated otherwise.

E. Install convenience receptacle 6 inches above counter or backsplash of counter.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726
SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Fusible switches.
   2. Non-fusible switches.
   3. Fuses.

1.2 RELATED SECTIONS

A. Division 1 – Submittal Requirements.
B. Section 260553 - Conduit.
C. Section 260519 - Building Wire and Cable.
D. Section 260529 - Supporting Devices.
E. Section 260553 - Electrical Identification.

1.3 REFERENCES

A. NEMA KS 1 - Enclosed Switches.
B. NFPA 70 - National Electrical Code.
C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
D. UL 198E - Class R Fuses.

1.4 SUBMITTAL

A. Submit under provisions of Division 1.
B. Product Data: Provide switch ratings and enclosure dimensions.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALIFICATIONS

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

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by a NRTL as suitable for purpose specified and shown.

1.7 EXTRA MATERIALS

A. Provide three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Electric

B. Siemens

C. Square D

D. Cutler-Hammer

2.2 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.

   1. Interior Dry Locations: Type 1.

2.3 FUSES

A. Manufacturers:

   1. Bussman
   2. Littlefuse
   3. Shawmut

B. Description: Dual element, current limiting, one-time fuse, 250 or 600 volt, UL 198E, Class RK

C. Interrupting Rating: 200,000 rms amperes.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated.

B. Install fuses in fusible disconnect switches.

C. Provide adhesive label on inside door of each switch indicating NRTL fuse class and size for replacement.

D. Support according to Section 260529.

E. Support to meet seismic requirements.

END OF SECTION 262816
SECTION 266100 - TESTING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor shall provide:
   1. Testing of electrical components and systems.
   2. Test reports.
   3. Correction of defective components or systems.
   4. Retest of corrected components or systems.

1.2 SUBMITTALS

A. Submit Test Reports: submit 3 copies of all test reports to Architect/Engineer.
   1. Type each test report on 8-1/2" x 11" paper. Include:
      a. Project Number.
      b. Project title and location.
      c. Test performed.
      d. Date performed.
      e. Test equipment used.
      f. Contractor's name, address and telephone number.
      g. Testing firm's name, address and telephone number, if other than Contractor.
      h. Name(s) and title(s) of person(s):
         1) Performing test.
         2) Observing test.
      i. Statement verifying each test.
      j. Nameplate data from each motor and equipment item tested.
      k. Test results.
      l. Retest results after correction of defective components, systems.

   2. For each copy, assemble all test reports and bind them in a folder. Label each folder, "Electrical Test Reports" and include Project Number, Title and Location.

PART 2 - PRODUCTS

2.1 MATERIALS. Furnish all equipment, manpower and casual labor to perform specified testing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that all electrical work is complete and ready for testing. All cables shall be terminated prior to testing. No cables shall be energized until all testing and corrections have been satisfactorily completed.

B. Disconnect all devices or equipment that might be damaged by application of test voltages, voltage of reversed phase sequence or other test procedures.
3.2 TESTING. Conduct tests and adjust equipment to verify compliance with specified performance.

3.3 INSULATION RESISTANCE TESTS

A. Resistance measured; Line-to-ground.

B. Perform testing on the following items:

<table>
<thead>
<tr>
<th>Item Tested</th>
<th>Voltage of Test</th>
<th>Min. Acceptance Resistance in Megohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No. 2 and larger cables (600V)</td>
<td>1000V</td>
<td>50</td>
</tr>
<tr>
<td>2. Motors</td>
<td>500V</td>
<td>5</td>
</tr>
<tr>
<td>3. Switchboard, Panelboard Buses</td>
<td>1000V</td>
<td>25</td>
</tr>
</tbody>
</table>

3.4 GROUNDING ELECTRODE TEST. Measure and record ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Maximum acceptable resistance: 10 ohms. When resistance exceeds 10 ohms drive and bond another ground rod, one ground rod length away and repeat test.

3.5 VOLTAGE TESTS

A. Make and record voltage tests at the following listed points. Conduct tests under normal load conditions.

1. Service entrance at main disconnect switch.
2. Secondary terminal of all step-down transformers.
3. Terminal switches.

3.6 PHASE RELATIONSHIP

A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.7 BRANCH CIRCUIT RECEPTACLES

A. All receptacles shall be tested for:

1. Ground continuity.
2. Polarity of hot and neutral.
3. Correct operation of ground fault circuit interrupting receptacles (where applicable).

B. Test reports may be submitted as exceptions only.

3.8 CORRECTION OF DEFECTS

A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.

B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.
PART 1 GENERAL

1.1 SUMMARY

A. Provide earthwork operations. The Contractor shall be responsible for the excavation of all footings and foundations in addition to preparing the pavement subgrade. The Contractor shall extend all utility excavations and services and make final, permanent connections to utility services as required.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Test Reports: Submit for approval test reports, list of materials and gradations proposed for use. Obtain samples of any proposed fill material and contractor to provide standard proctor test reports to engineer. Supply in-place compaction reports from an independent testing service for all fill materials placed.

1.3 QUALITY ASSURANCE

A. Compaction:

1. Under structures, building slabs, steps, pavements, and walkways, 95 percent Standard Proctor minimum density, ASTM D 698.
2. Under lawns or unpaved areas, 85 percent, ASTM D 698.

B. Grading Tolerances Outside Building Lines:

1. Lawns, unpaved areas, and walks, plus or minus 1 inch.
2. Pavements, plus or minus 1/2 inch

PART 2 PRODUCTS

2.1 MATERIALS

A. Earthwork:

1. Application: Excavation, filling, compacting and grading operations both inside and outside building limits as required for below-grade improvements and to achieve grades and elevations indicated. Provide trenching and backfill for mechanical and electrical work and utilities. Note: all graded gravel or crushed stone shall be provided by the Contractor.

2. Application: Subbase materials, drainage fill, common fill, and structural fill materials for slabs, pavements, and improvements.

3. Application: Suitable fill from off-site if on-site quantities are insufficient or unacceptable, and legal disposal of excess fill off-site.

4. Subbase Material: Graded gravel or crushed stone.

5. Bedding Course: Graded crushed gravel and sand.
7. Drainage Fill: ashed gravel or crushed stone.
10. Impervious Fill: Gravel and sand mixture.
11. Fill in landscape areas (excluding 6" of topsoil): Suitable soil within 36" of finish grade in lawn and planter areas shall be cohesive soils in the soil classification groups ML, CL, CH or a combination thereof, free of rock or gravel larger than 1" in any dimension, debris, waste, frozen material, vegetation and other deleterious material.

PART 3 EXECUTION

3.1 INSTALLATION

A. All activities will be contained within construction boundaries indicated on site plan. Specified excavation requirements, precautions, and protective systems will be observed at all times.

B. Movement of trucks and equipment on Owner’s property will be in accordance with Owner’s instructions.

C. Topsoil will be stripped from the construction site and stockpiled in designated area. Excess topsoil will be stripped and disposed of legally off site.

D. Trenches will not be backfilled until all required tests are completed and the utility systems, as installed, conform to requirements specified by the contract documents.

E. Excavation is unclassified and includes excavation to subgrade regardless of materials encountered. Repair excavations beyond elevations and dimensions indicated as follows:
   1. At Structure: Concrete or compacted structural fill.
   2. Elsewhere: Backfill and compact as directed.

F. Maintain stability of excavations; coordinate shoring and bracing as required by authorities having jurisdiction. Prevent surface and subsurface water from accumulating in excavations. Stockpile satisfactory materials for reuse, allow for proper drainage and do not stockpile materials within drip line of trees to remain.

G. Compact materials at the optimum moisture content as determined by ASTM D 698 by aeration or wetting to the following percentages of maximum dry density:
   1. Structure, Pavement, Walkways: Subgrade and each fill layer to 95% (-2%+4%) of Standard Proctor maximum dry density to suitable depth. Compaction testing shall be performed immediately prior to the placement of reinforcing steel and new paving materials. Contractor shall be responsible for scheduling testing with owners designated testing agency.
   2. Unpaved Areas: Each fill layer to be 85% maximum dry density.
   3. A proof-roll shall be required of the subgrade prior to placement of the
base course. Proof rolling shall consist of passing a loaded, 20-ton, tandem dump truck over the prepared subgrade soil with a maximum allowable displacement of 1”. Any areas that displace more than 1” shall be compacted until this criterion is met, or those areas may be excavated and backfilled with compacted Type 1 aggregate used for base material. All proof rolling shall be performed in the presence of the Owner’s representative.

4. **Cut areas under proposed asphalt or concrete pavements shall be cut and compacted. After grading to subgrade elevation, scarify the top six inches of the sub-base and compact as outlined above.**

5. Landscaped areas to be left 6” below proposed finish grade. Fill within 36” of finish grade to be fill per “Fill in Landscaped areas” as defined by 2.1-A.11

H. Place acceptable materials in layers not more than 8” loose depth for materials compacted by heavy equipment and not more than 4” loose depth for materials compacted by hand equipment to subgrades indicated as follows:

1. Structural Fill: Use under foundations, slabs on grade in layers as indicated.
2. Drainage Fill: Use under designated building slabs, at foundation drainage and elsewhere as indicated.
3. Common Fill: Use under unpaved areas.
4. Subbase Material: Use under pavement, walks, steps, piping and conduit.

I. Grade to within 1/2” above or below required subgrade and within a tolerance of 1/2” in 10’.

J. Protect newly graded areas from traffic and erosion. Recompact and regrade settled, disturbed and damaged areas as necessary to restore quality, appearance, and condition of work.

K. Control erosion to prevent runoff into sewers or damage to sloped or surfaced areas.

L. Control dust to prevent hazards to adjacent properties and vehicles. Immediately repair or remedy damage caused by dust including air filters in equipment and vehicles. Clean soiled surfaces.

M. Disposal of excavation waste and unsuitable materials shall be the responsibility of the site work contractor. No specific or pre-approved location is being provided by the owner.

END OF SECTION 31 2000
SECTION 33 1113 WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

1.3 DEFINITIONS

A. HDPE: High-Density Polyethylene Plastic

B. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: water valves and specialties to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with standards of Missouri Department of Natural Resources for potable-water-service piping, including materials, installation, testing, disinfection, and all requirements of the MU system guidelines.
B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including yard hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrant if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 MATERIALS, PIPE AND PIPE FITTINGS

A. All underground water piping shall be PVC.
   1. EXCEPTION 1: Domestic water service lines 2” or less shall be Type K copper or high density polyethylene (HDPE) piping.
2. EXCEPTION 2: Lines passing directly over or under steam tunnels or direct buried steam/condensate lines must be ductile iron or Type K copper (2” or less) with 4” R-5 extruded polystyrene insulation board between the pipe and steam lines.

B. PVC Pipe (Open Trench Construction)
1. 2 Inches to 12 Inches: AWWA C900; Pressure Class 235 (DR 18); Cast Iron O.D. equivalent; with bell end and elastomeric gasket.
2. 14 Inches to 48 Inches: AWWA C905; Pressure Rating 165 (DR 25); Cast Iron O.D. equivalent; with bell end and elastomeric gasket.

C. Ductile-Iron Pipe
1. 4 Inches to 12 Inches: AWWA C151; Mechanical Joint Pipe; Minimum Thickness Class 52 or Pressure Class 350; with integrally cast flanged bell, cast iron gland, and rubber gasket.
2. Lining: Standard cement lining with asphalt coating.

D. High-Density Polyethylene (HDPE) Pipe and Fittings
1. 2 Inches and Less: SDR9 CTS Premium Grade Pipe, AWWA C901, ASTM D3035, NSF 14 and 61, 200 psi pressure rating. Pipe to be CenCore HDPE as manufactured by Centennial Plastics or approved equal.
2. Fittings and Joints: All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe pressure rating. All fittings shall be molded or fabricated by the pipe manufacturer. Connections must be made by either the use of brass/stainless steel compression couplings with insert rings or by creating a fusion butt weld all in strict accordance with manufacturer’s recommendations. All brass fittings shall be lead free.

E. Pipe Fittings
1. 4 Inches to 24 Inches: AWWA C153; 350-psi pressure rating.
2. Lining: Standard cement lining with asphalt coating.
3. All pipe fittings shall be cast-iron construction, installed wrapped with AWWA C105 polyethylene film.

F. Restraints
1. Mechanical joint: AWWA C111. Provide retainer type packing glands with rubber gasket, for use with PVC pipe and conforming to Uni-B-13-92. Pipe sizes 4” to 12” must also be FM approved. Mechanical joint restraints shall be Megalug 2000 PV, as manufactured by EBAA Iron Inc., Eastland TX, or approved equal.
2. Joint Retainers: Provide ductile iron split serrated ring harnesses and rod type joint retainers for PVC bell and spigot joints. Clamps shall be designed for use with PVC pipe and shall meet Uni-B-13-92 Standards and be FM approved on sizes 4” to 12”. Restraint harnesses shall be Series 1500 for pipe 4 inches to 12 inches, and Series 2800 for pipe 14 inches and larger, all as manufactured by EBAA Iron Inc., Eastland TX or approved equal.
3. Rods, nuts and washers: ¾” SS304 all thread rods, nuts and washers.
5. All pipe restraints and ductile iron fittings shall be installed wrapped with AWWA C105 polyethylene film.

6. Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Link-Seal® as manufactured by PSI-Thunderline Corporation, Houston TX, or approved equal.

7. Pipes, fittings, valves, meters, and other appurtenances containing more than .25 percent lead calculated by weighted average shall not be used. System design, materials, and installation of water systems shall comply with "Minimum Design Standards for Missouri Community Water Systems" (latest edition) as published by Missouri DNR.

G. Trace Wire
1. Tracer wire shall be #14 AWG Solid, steel core soft drawn high strength tracer wire, 250# average tensile break load, 30 mil high molecular weight-high density blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating. No THHN insulated wire shall be allowed. Tracer wire shall be Copperhead Industries HS-CCS or approved equal.
2. Tracer wire shall have moisture resistant splices for direct bury applications. Splices shall be Copperhead Industries Snakebite or 3M DBR or approved equal.
3. Tracer wire test stations shall be designed to be easily detected by magnetic and electronic locators. A magnet shall be securely attached at the top of the upper tube of the box for locating purposes. Lid shall be blue and have a brass terminal for attaching locating equipment and a brass 5 sided nut for removing cap. Tracer wire test station shall be Copperhead Industries Snake Pit or approved equal.

2.2 JOINING MATERIALS

A. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to ends compatible with, piping to be joined.
1. Dielectric-Flange Insulating Kits:
   a. Description:
      1) Nonconductive materials for field assembly of companion flanges.
      2) Pressure Rating: 150 psig
      3) Gasket: Neoprene or phenolic
      4) Bolt Sleeves: Phenolic or polyethylene
      5) Washers: Phenolic with steel backing washers.

2. Dielectric Nipples
   a. Description
      1) Standard: IAPMO PS 66
      2) Electroplated steel nipple, complying with ASTM F 1545
      3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C)
      4) End Connections: Male threaded and grooved
      5) Lining: Inert and noncorrosive, propylene.
2.4 VALVES AND VALVES BOXES

A. Non-rising Stem Gate Valves: ANSI/AWWA C509, resilient seated, lead free, bronze stem, cast-iron or ductile-iron body and bonnet, epoxy coated disc, stem nut, 250 psig working pressure, mechanical joint ends. Valves shall be Model A-2360 as manufactured by Mueller Company, Decatur IL, or approved equal. Valves shall turn clockwise to close.

B. Ball Valves: Threaded lead free bronze, 125 lb., 2-piece design, full port. Valves shall be Model T-FP-600A-LF-LL as manufactured by NIBCO, Elkhart IL, or approved equal.

C. Valve Boxes: Valve box shall be 6" PVC C900 pipe with cast iron cover No. 2195 as manufactured by Clay and Bailey Manufacturing Company, Kansas City MO, or approved equal. Lid shall be marked "WATER". Provide below grade concrete collar in planted and asphalt areas.

2.5 HYDRANTS

A. University fire hydrants shall be lead free Super Centurion Fire Hydrants, Model 250, Number A-423, as manufactured by Mueller Water Products, Decatur IL.

B. Fire hydrants shall be painted in the following manner using Sign Painters' 1 Shot Lettering Enamel or approved equal
1. University water: Barrel - Metallic Gold, Caps - Black, Bonnet Blue
2. City water, University maintained fire system: Barrel - Metallic Gold, Caps Blue, Bonnet - Red.
3. Final hydrant bonnet color based on measured flow will be painted by MU.

C. Tracer Wire
1. Tracer wire shall be #14 AWG Solid, steel core soft drawn high strength tracer wire, 250# average tensile break load, 30 mil high molecular weight-high density blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating. No THHN insulated wire shall be allowed. Tracer wire shall be Copperhead Industries HS-CCS or approved equal.
2. Tracer wire shall have moisture resistant splices for direct bury applications. Splices shall be Copperhead Industries Snakebite or 3M DBR or approved equal.
3. Tracer wire test stations shall be designed to be easily detected by magnetic and electronic locators. A magnet shall be securely attached at the top of the upper tube of the box for locating purposes. Lid shall be blue and have a brass terminal for attaching locating equipment and a brass 5 sided nut for removing cap. Tracer wire test station shall be Copperhead Industries Snake Pit or approved equal.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 “Earth Moving” for excavating, trenching, and backfilling.
3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fitting may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) 1-inch to 2-inch shall be the following:
   1. PE, ASTM pipe; insert fittings for PE pipe; and clamped joints.

3.3 PIPING INSTALLATION

A. Preparation of Trench
   1. Trench bottom shall be graded to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.
   2. All rock greater than one inch in diameter found in the trench shall be removed for a depth of six inches below the bottom of the pipe and replaced by suitable bedding material.
   3. Unstable, soft, and unsuitable materials shall be removed at the surface upon which pipes are to be laid and backfill with crushed stone as indicated on the drawings.
   4. Layers of crushed stone shall be installed in the bottom of trench as indicated on the drawings. Shape stone layer to fit bottom of piping. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

B. Pipe Separation
   1. Finished pipe installation shall have minimum 12” separation to all other utilities.
   2. Maintain at least a ten foot (10’) horizontal separation of water mains from any existing or proposed sanitary sewer. The distance must be measured edge to edge. Installation of the water main closer to a sanitary sewer is acceptable where the water main is laid in a separate trench or on an undisturbed earth shelf located on one (1) side of the sanitary sewer at an elevation so the bottom of the water main is at least eighteen inches (18”) above the top of the sanitary sewer.
   3. Provide a minimum vertical distance of eighteen inches (18”) between the outside of the water main and the outside of the sanitary sewer where water mains cross the sanitary sewer mains. This shall be the case where the water main is either above or below the sanitary sewer. At crossings, one (1) full length of water pipe must be located so both joints will be as far from the sanitary sewer line as possible. Special structural support for the water and sanitary sewer pipes may be required.
4. Provide at least a ten-foot (10’) horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen-inch (18”) vertical separation at crossings.

5. Locate water mains so that they do not pass through or come in contact with any sanitary sewer manhole.

6. Consult the system owner where above conditions cannot be met.

C. Installation of Pipe and Pipe Fittings

1. Piping 2” and less:
   a. All domestic water service piping from the water main to the building with a nominal diameter of two inches and less shall be Type K copper or HDPE piping.
   b. In all installations, Type K copper shall be used where the water line enters the building. If the water meter is located in a meter pit, the piping within the meter pit, and stubbed out on either side shall also be Type K copper.
   c. All buried copper piping shall be wrapped.
   d. For pulled pipe installations, tracer wire shall be pulled with pipe, without splices. Upon completion of installation, a continuity test on the wire shall be performed and all breaks shall be repaired.
   e. For trenched pipe installation, tracer wire shall be taped to the pipe at the three o’clock position every 5 feet. Upon completion of installation, a continuity test on the wire shall be performed and all breaks shall be repaired.

2. PVC (Polyvinyl Chloride) Pipe: Install in accordance with AWWA C605.

3. All joints shall be restrained with joint retainers. All fittings shall be restrained with retainer type packing glands.

4. Install stainless steel rods between fittings on all offsets and between fittings, valves, and blind flanges, in addition to the Megalugs. On isolated fittings, valves, etc., attach restraint rings to PVC pipe and install stainless steel rods between fitting and restraint rings. Rods shall be positioned through the bolt holes in fitting and Megalug. Each rod will require four nuts and washers. Duct lugs are acceptable. The number of stainless steel rods required per fitting flange shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>No. of Rods</th>
</tr>
</thead>
<tbody>
<tr>
<td>10” and Less</td>
<td>2</td>
</tr>
<tr>
<td>12”</td>
<td>3</td>
</tr>
<tr>
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5. All ductile iron pipe, fittings, valves, bell end restraints, etc. shall be wrapped with a polyethylene cover conforming to AWWA C105, and installed per AWWA C600.

6. All dead end mains shall have a dry barrel fire hydrant at the end to facilitate flushing of the main.

7. Pipe shall be installed in clean condition, and shall never be laid in trenches with standing water. The trench shall be dewatered during installation of the water line. Open pipe ends shall be protected with a hard cap or inflatable plug at the
end of the work day. NO PLYWOOD OR DUCTTAPE COVERINGS WILL BE ALLOWED.

D. Backfill
1. Under Pipe: All backfill under the barrel of the pipe shall be free from debris, organic matter, and stones larger than one inch, and shall be tamped into place. Sand or crushed stone aggregate (95% passing a ½” screen but not more than 10% passing a #200 sieve) are acceptable substitutes for soil.
2. Adjacent To and Top of Pipe: The first one foot of backfill over the top of pipe shall be “3/4 inch minus waste rock with fines” uncleaned crushed stone aggregate or suitable soil. Backfill shall be free of debris, brush, roots and stones or rubble more than one inch.
3. Rough final grading of subgrade and the placement of final topsoil shall be detailed on the drawings.
4. All sidewalks, paving, etc. which are removed or damaged during construction shall be replaced and shall match existing.

E. Identification
1. Install continuous plastic underground warning tape during back-filling of trench for underground water piping. Tape shall be located twenty-four (24) inches above pipe, directly over each water line.
2. Tape trace wire to the top of each water line with duct tape every five (5) feet. Wire splices shall be minimized. Terminate trace wires inside building and inside valve boxes. Drill ¼” hole in PVC valve box one inch below cast iron cover. Route wire up outside of valve box, through ¼” hole and knot. A tracer wire test station shall be installed at all fire hydrants and at all runs of piping without valves every 400 feet. Upon completion of installation and final grading, a continuity test on the wire shall be performed and all breaks shall be repaired.

F. Install HDPE pipe according to ASTM D 2774 and ASTM F 645.

G. Bury piping with depth of cover over top at least 42 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 42 inches (910 mm) cover over top
2. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) additional cover.

H. Extend water-service piping and connect to water-supply source and building-water piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

3.4 VALVE/VALVE BOX INSTALLATION

A. Valve Installation.
1. Domestic Water Service: AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with valve box.
2. Valve boxes shall be installed vertically with top of box even with final grade.

3.5 CONNECTIONS

A. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.6 FIRE HYDRANT INSTALLATION

A. Installation of fire hydrants maintained by the University shall be installed per “Fire Hydrant Detail” and in strict accordance with manufacturer’s written instructions.

B. The pumper nozzle shall be installed pointing to the street and/or away from the building.

C. Newly installed fire hydrants shall be cleaned and pressure tested in accordance with standards set forth in section 3.7 below.

3.7 FIELD QUALITY CONTROL

A. Cleaning

1. All domestic potable water systems shall be clean and free of foreign matter and shall be disinfected and tested for bacteriological contamination before the system is put into operation, as required by the State Division of Health and in accordance with AWWA C651 or C652.

2. All domestic potable water systems will be pressure tested in accordance with AWWA M23.

3. Disinfection shall be performed AFTER leak and pressure tests are completed.

4. Water line shall be completely separated from water system for pressure test and disinfection purposes.

5. Contractor shall install number and size of taps based on the water line size in the table below:

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>2&quot; Taps Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>1</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1</td>
</tr>
<tr>
<td>8&quot;</td>
<td>1</td>
</tr>
<tr>
<td>10&quot;</td>
<td>2</td>
</tr>
<tr>
<td>12&quot;</td>
<td>2</td>
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</tbody>
</table>

6. Contractor shall install water line entrance and exit piping which enters and exits above ground as shown in “Taps for Flushing and Disinfection of Water Line drawing referenced below. The purpose of this piping is to provide a means for flushing, pressure testing, and disinfecting the new water line.

7. MU will perform pressure testing and disinfection of new water lines. Contractor shall prepare water line for testing and disinfection. Notify Owner's Representative at least 72 hours prior to requesting disinfection of a new water line. Owner will draw and send samples for testing. Allow 24 hours for disinfection of the water line and an additional 48 hours for return of testing prior
to connecting to existing system. Contractor to allow a minimum of 5 working days in schedule for this work by owner.

8. Fill the system with a water-chlorine solution containing at least 50 parts per million of chlorine, valve off, and allow to stand for at least twenty-four (24) hours; or fill system with a water-chlorine solution containing at least 200 parts per million of chlorine, valve off, and let stand for three (3) hours.

9. After allowed standing time, flush the system with clean potable water until no chlorine (in excess of public water supply) remains at any point of outlet.

10. The system shall be thoroughly and completely flushed at maximum water pressure, and if it is shown by a bacteriological examination made by the Owner that contamination still persists in the system, the above procedure shall be repeated.

11. The contractor shall be responsible for taking and sending the sample for testing.

12. The system owner will be financially responsible for first bacteriological test on a section of line to be tested. The cleaning procedure shall be repeated if biological examination shows evidence of contamination. Costs incurred due to subsequent testing from an initial positive sample shall be paid for by the installers.

13. Allow forty-eight (48) hours for return of testing before making tie-ins to existing system.

3.8 COMMISSIONING

A. System shall be placed in operation only after testing shows the absence of bacteriological contamination and approved by system owner.

B. Only Campus Facilities - Energy Management Steam and Water personnel will be allowed to operate valves on new water systems. All valves installed as part of new construction shall remain fully closed during construction.
33 4100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

   1. Special fittings for expansion and deflection.
   2. Cleanouts.
   3. Drains.
   4. Precast concrete, cast-in-place concrete, or plastic junction boxes.

1.3 DEFINITIONS

A. HDPE: High density polyethylene plastic.
B. PVC: Polyvinyl chloride plastic.
C. RCP: Reinforced concrete pipe.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Special pipe fittings.
   2. Drains.
   3. Channel drainage systems.

B. Shop Drawings: For the following:
1. Manholes: Include plans, elevations, sections, details, and frames and covers.
2. Catch Basins and Stormwater Inlets: Include plans, elevations, sections, details, and frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, and design calculations.

C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes according to manufacturer's written rigging instructions.
D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.

1. Special-Joint Bands: Corrugated steel with O-ring seals.
3. Coating: Aluminum.

2.2 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.
B. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.


D. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M) or AASHTO M170, with bell-and-spigot or groove and tongue ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.
   1. Class III, Wall C.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.5 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 JUNCTION BOX/ MANHOLE STRUCTURES

A. Precast Concrete Junction Box/Manholes: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
   1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole, as required to prevent flotation.
3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.

4. Steps: Steps shall be Neenah 1980-J, Deeter 1606, M.A. Industries PS2-PF, or equal. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

6. Protective Coating: Plant-applied, coal-tar; 10-mil (0.26-mm) minimum thickness applied to exterior surfaces.

7. Manhole Frames and Covers: Deeter 1247, Neenah R-1642, or exact equal frame and lid. The lid shall be lettered with the words ‘Storm Sewer’ or ‘Storm Drain’.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.8 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA’s "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).


PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 2000 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
   
   a. Unshielded flexible couplings for same or minor difference OD pipes.
   
   b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   
2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use pipe materials as shown on the Site Development Plans.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install
gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install corrugated steel piping according to ASTM A 798/A 798M.
4. Install corrugated aluminum piping according to ASTM B 788/B 788M.
5. Install HDPE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 2 Section "Piped Utilities - Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
2. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
3. Join corrugated HDPE piping according to CPPA 100 and the following:
   a. Use silttight couplings for Type 1, silttight joints.
   b. Use soiltight couplings for Type 2, soiltight joints.
4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
5. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
7. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections according to ASTM C 891.
C. Construct cast-in-place manholes as indicated.
D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
B. Construct riprap of broken stone, as indicated.
C. Install outlets that spill onto grade, anchored with concrete, where indicated.
D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
E. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."

3.10 PAINTING
A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

1. Cast-in-Place-Concrete Manholes: All exterior, except bottom.
2. Precast Concrete Manholes: All exterior.

B. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied, corrosion-resistant coating.

3.11 IDENTIFICATION

A. Materials and their installation are specified in division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
   b. Option: Test plastic piping according to ASTM F 1417.
   c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

C.Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 33 4100
SECTION 336113 - HYDRONIC ENERGY DISTRIBUTION

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation and testing of chilled water piping installed for the University of Missouri.

1.1 DESIGN GUIDELINES:

A. Materials

1. Ductile-Iron Pipe:
   a. 4 Inches to 36 Inches: AWWA C151; Mechanical Joint Pipe; 150 psi working pressure; Minimum Thickness Class 50; with integrally cast flanged bell, cast iron gland, and rubber gasket.
   b. Lining: Standard cement lining with asphalt coating.
   c. Encasement: AWWA C105, polyethylene film.

2. Ductile-Iron Pipe Fittings:
   a. 4 Inches to 24 Inches: AWWA C153; 350-psi pressure rating.
   b. Lining: Standard cement lining with asphalt coating.
   c. Encasement: AWWA C105, polyethylene film.
   d. Fitting Restraint:
      1) Mechanical joint: AWWA C111. Provide retainer type packing glands with rubber gasket, for use with PVC pipe and conforming to Uni-B-13-92. Pipe sizes 4” to 12” must also be FM approved. EBAA Megalug 2000 PV or approved equal.
      2) Rods, nuts and washers: ¾" SS304 all thread rods, nuts and washers.
      3) Joint Retainers: Provide ductile iron clamp and rod type joint retainers for PVC bell and spigot joints. Clamps shall be designed for use with PVC pipe and shall meet Uni-B-13-92 Standards and be FM approved on sizes 4” to 12”.
      4) EBAA Series 1600 for pipe 4 inches to 12 inches, or approved equal.
      5) EBAA Series 2800 for pipe 14 inches and larger, or approved equal.
      6) Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Link-Seal by Thunderline Corporation or equal.
B. Installation

1. Preparation of Trench
   a. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping. All rock greater than one inch in diameter found in the trench shall be removed for a depth of six inches below the bottom of the pipe and replaced by suitable bedding material.
   b. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with crushed stone as indicated on the drawings.
   c. Provide layers of crushed stone in the bottom of trench as indicated on the drawings. Shape stone layer to fit bottom of piping. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.
   d. Finished pipe installation shall have minimum 12" separation to all other utilities.

2. Installation of Pipe and Pipe Fittings
   a. All joints shall be restrained with joint retainers. All fittings shall be restrained with retainer type packing glands.
   b. Install stainless steel rods between fittings on all offsets and between fittings, valves, and blind flanges, in addition to the Megalugs. On isolated fittings, valves, etc., attach restraint rings to PVC pipe and install stainless steel rods between fitting and restraint rings. Position rods through the bolt holes in fitting and Megalug. Requires four nuts and washers on each rod. Duct lugs are acceptable. The number of stainless steel rods required per fitting flange are as follows:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>No. of Rods</th>
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<tr>
<td>to 10”</td>
<td>2</td>
</tr>
<tr>
<td>12”</td>
<td>3</td>
</tr>
<tr>
<td>14”</td>
<td>4</td>
</tr>
<tr>
<td>16”</td>
<td>5</td>
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<td>18”</td>
<td>8</td>
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<tr>
<td>20”</td>
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<tr>
<td>24”</td>
<td>12</td>
</tr>
<tr>
<td>30”</td>
<td>14</td>
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<tr>
<td>36”</td>
<td>14</td>
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</tbody>
</table>

   c. Ductile iron pipe, fittings and valves shall be wrapped with a polyethylene cover conforming to AWWA C105. Install per AWWA C600.
d. Pipe shall be installed in clean condition, and shall never be laid in trenches with standing water. Contractor shall make provisions to keep the trench dewatered during installation of the water line. Protect open pipe ends with a hard cap or inflatable plug at the end of the work day. NO PLYWOOD OR DUCTTAPE COVERINGS WILL BE ALLOWED.

e. Trace wire shall be pulled with pipe, without splices.

f. Tape trace wire to the top of each water / chilled water line with duct tape every 5 feet. Contractor shall minimize wire splices. Terminate trace wires inside building and inside valve boxes. Drill ¼” hole in PVC valve box 1” below cast iron cover. Route wire up outside of valve box, through ¼” hole and knot. Trace wire shall be tested for continuity in presence of Owner's Representative, after pulling is completed.

g. Install continuous plastic underground warning tape during back-filling of trench for underground water / chilled water and compressed air piping. Locate 24 inches above pipe, directly over each water line.

C. Trace Wire

1. Tracer wire shall be #14 AWG Solid, steel core soft drawn high strength tracer wire, 250# average tensile break load, 30 mil high molecular weight-high density blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating. No THHN insulated wire shall be allowed. Tracer wire shall be Copperhead Industries HSCCS or approved equal.

2. Tracer wire shall have moisture resistant splices for direct bury applications. Splices shall be Copperhead Industries Snakebite or 3M DBR or approved equal.

3. Tracer wire test stations shall be designed to be easily detected by magnetic and electronic locators. A magnet shall be securely attached at the top of the upper tube of the box for locating purposes. Lid shall be blue and have a brass terminal for attaching locating equipment and a brass 5 sided nut for removing cap. Tracer wire test station shall be Copperhead Industries Snake Pit or approved equal.

D. Testing

1. Field Quality Control

a. Piping Tests: Leak and pressure tests shall follow procedures outlined in AWWA M23. Conduct piping tests before joints are covered. Use only potable water.

b. Simultaneous Tests: Conduct leak and pressure testing at the same time. All tests shall be conducted in the presence of the Owner’s Representative or their designee. Test at not less than 100 psig for 1 hour.

c. Test Report: Submit Test Reports to the Owner’s Representative.
2. Cleaning
   
a. Cleaning of all piping shall be performed as detailed in section 331300 Disinfecting of Water Utility Distribution. Chilled water distribution piping does not require disinfection.

E. Commissioning
1. System shall be placed in operation only after piping has been leak tested, flushed clean and approved by system owner personnel.

F. REFERENCES

1. 336113 Branch Connection
2. 336113 Chilled Water Conduit Wall Penetration Detail
3. 336113 Chilled Water Junction Box Drawing
4. 336113 Chilled Water Pipe Wall Penetration Drawing
5. 336113 Chilled Water Vent Box Drawing
6. 336113 Steam Tunnel Crossing Drawing
7. 336113 Trench at Asphalt Paving Drawing
8. 336113 Trench at Street Drawing
9. 336113 Trench in Grass Drawing
10. 336113 Vertical Offset Drawing

END OF SECTION 336113
PART 1 - GENERAL:

The scope of this document is to provide instruction for the installation, testing, and design of exterior underground steam and condensate piping installed.

Equipment and materials specified under these standards are to also be applied to steam and condensate service lines located inside the building, up to, and including the first building steam shutoff valve installed downstream of the steam meter, and the first building condensate shutoff valve.

1.1 GENERAL GUIDELINES:

A. Existing Conditions

1. The University of Missouri – Columbia owns and operates a medium-pressure steam supply system that distributes steam from the University power plant to all campus buildings. A pumped condensate system returns steam condensate to the power plant from each building. This steam and condensate system is piped within a network of steam chases/tunnels and manholes.

B. General Mechanical Requirements

1. Steam and condensate mains and services shall be installed in reinforced concrete chases, walk tunnels and manholes. All installed equipment and piping shall be accessible for maintenance and installed in manholes. All piping and structure installations shall be installed in a manner to provide drainage of any water introduced into the systems. All systems shall also be ventilated either by natural or power ventilation.

2. Design Temperature and Pressure:

a. A maximum operating pressure of 75 psig and a maximum operating temperature of 450°F shall be used as the design conditions for steam.

b. A maximum operating pressure of 75 psig and a maximum operating temperature of 200°F shall be used as the design conditions for condensate.

3. Pipes shall be installed so as to conform to the ASME Power Piping Code, ANSI 31.1 (as last revised) "Power Piping”

4. Steam and condensate piping shall be typically 2”, 3”, 4”, 6”, 8”, 10” or 12”. All service line connections to steam and condensate mains shall include a “three-valve” cluster which will allow for maximum valving flexibility.

5. All steam valves 6” and larger shall have a warm-up line to facilitate safe start-up of the steam line.

6. All valves shall be located, sized, and the type shall be selected.
7. All systems shall be completely assembled, tested, adjusted and demonstrated to be ready for operation to the satisfaction of the Owner before steam will be turned on.

8. Pipe Expansion:
   a. Expansion loops or mechanical expansion joints are to be used for piping expansion compensation.

9. Steam Traps
   a. Individual steam traps shall not serve more than one drain point.

C. Installation

1. Welding and Brazing
   a. All welding, brazing, soldering and cutting work shall conform to applicable provisions of the following codes and requirements:

2. Welding and brazing shall be performed only by skilled welders. Welders, and welding and brazing procedures shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. A record shall be maintained on the job showing the date and results of qualification test for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's Representative.

D. Testing

1. 1. On any given construction project, the owner will contract with an independent testing firm to complete ultrasonic shearwave weld inspections on owner selected field welds. If the results of these tests indicate poor quality welds, those “failed” welds shall be replaced at no additional cost to the project. If further ultrasonic inspection is required to assure quality weld workmanship, these tests shall be at the expense of the contractor, and any and all defective welds shall be replaced at no additional cost to the project.
   
2. All welds installed in chases and manholes will be subject to testing.

E. Scheduling

1. Site utility tie-ins shall be coordinated with the Owner’s Representative.
F. Commissioning

1. Steam and condensate shall be turned on by Energy Management Utility Distribution personnel only. Owner’s Representative will coordinate.

END OF SECTION 336311
PART 1 - GENERAL

The scope of this document is to provide instruction for the installation and testing of buried steam and condensate distribution piping.

1.1 DESIGN GUIDELINES:

A. Materials

1. Pipe and Pipe Fittings

a. Drawings shall indicate piping with the following abbreviations:

1) Medium Pressure Steam: MPS
2) Medium Pressure Condensate: MPC
3) Pumped Condensate: PC
4) Manhole Drain: D

b. Fabrication:

1) 2” and under in chase, tunnels and manholes: Socket Welded
2) 2” and under for accessible steam trap piping in manholes and tunnels: Threaded
3) 2- 1/2” and above: Welded and Flanged

c. Pipe:

1) Seamless Carbon Steel, ASTM A53 Grade B
2) Steam (MPS): Schedule 40 to 10”, 0.375” wall for 12” and above.
3) Condensate (MPC, PC): Schedule 80
4) All threaded pipe: Schedule 80

d. Fittings:

1) 2” and under in chase, tunnels and manholes: Class 3000 Socket weld forged steel fittings. ASTM A105, ANSI B16.11.
2) 2” and under steam trap piping in manholes and tunnels: Class 2000 Threaded forged steel fittings. ASTM A105, ANSI B16.11.
3) 2- 1/2" and above: Butt welding carbon steel, ASTM A234, ANSI B16.9, elbows to be long radius unless otherwise called for. Use Standard Weight with Schedule 40 and 0.0375" wall pipe, Extra Heavy with Schedule 80 pipe.

e. Unions and Flanges:
   2) Flanges: 150 lb. forged steel welding neck, ASTM A105, ANSI B16.5
   3) Gaskets: Steam and Condensate: Spiral wound, Class 150, Style CG or CGI, 304 SS/ Industrial Grade “Flexicarb” as manufactured by Flexitallic Group, Houston, Texas, or approved equal.
   4) Bolting: ASTM A193, Grade B7 alloy steel stud bolts with heavy hex nuts, ASTM A194, Grade 2 H.
   5) Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Model “T” Link-Seal® as manufactured by PSI -Thunderline Corporation, Houston TX, or approved equal.

f. Sump Pump Discharge
   1) Fabrication: Up to 3": Brazed joint with threaded valves.
   2) Pipe: Seamless copper tubing, ASTM B88, Type K, hard drawn.
   3) Fittings: 1/2" and above: Wrought copper solder joint pressure fittings, ANSI B16.22.
   4) Brazing Fill Metal: AWS BCuP-5 (I5% Ag, 80%Cu, 5%P).
   5) Unions: Wrought copper/cast copper alloy.
   7) Gaskets: 1/16" non-asbestos compressed gasket material. Chesterton195, Garlock 3000, or equal.
   8) Bolting: ASTM A307, Grade B, heavy hexagon carbon steel bolts with heavy semi-finished hexagonal nuts.

B. Installation
   1. Cleaning
      a. Prior to assembly of pipe and piping components, all loose dirt, scale, oil and other foreign matter on internal or external surfaces shall be removed by means consistent with good piping practice. Chips and burrs from thread cutting operations shall be blown out of pipe before assembly. Cutting oil shall be
removed from internal and external surfaces.

b. During fabrication and assembly, slag and weld spatter shall be removed from pipe joints by peening, chipping and wire brushing.

2. Pipe Erection

a. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Any items which are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.

b. Pipe lines shall be run straight and true with a minimum use of joints and with only such offsets as may be required to clear interferences, to provide necessary clearance or headroom, or provide the necessary flexibility in the piping system.

c. Changes in direction of pipe lines shall be made with approved fittings or pipe bends only. Miter joints in welded pipe assemblies shall not be used except where approved by Project Manager.

d. Expansion joints shall be used in lieu of large expansion loops.

e. Backing rings shall not be used on butt welded joints.

f. All prefabricated piping shall be arranged with extra tangent, loose flanges, field joints or other provisions to permit field adjustment to suit construction tolerances and to avoid interferences.

g. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.

h. Pipe shall be cut to exact measurement and installed without springing or forcing. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or structural elements with piping connections or piping supports.

i. All threaded pipe work is to be assembled with full threads, including all fittings, valves, unions and specialties. Threads shall be full and clean cut and the pipe shall be reamed and filed, removing all burrs from the interior. Threaded work shall be made up with a suitable pipe joint compound.

j. All pipe shall be erected and supported in such a manner as to provide for expansion and contraction without harmful strain to structural members, pipe and pipe supports.

k. Consideration shall be given to insulation thickness when routing piping such that adequate clearance is provided to avoid interfering with insulation.

l. All piping in pipe trenches shall be welded regardless of size.
3. **Branch Connections**
   a. Branch connections shall be made with standard tees and 45° laterals of the type required for the service.
   b. In place of standard tees and 45° laterals in black steel piping systems, integrally reinforced weld-on fittings may be used providing branch the line is at least two pipe sizes under run pipe size.

4. **Draining and Venting**
   a. Maintain constant slope so lines are pitched for venting and drainage. No lines shall have pockets due to changes in elevation unless proper provisions for draining and venting are provided.
   b. Provide 1/2" drain valves fitted with 3/4" hose thread adapter at all low points of steam or condensate piping systems to permit complete or sectionalized draining.
   c. Provide manual air vents at the high points of condensate piping systems.

5. **Sleeves**
   a. Furnish and install sleeves for all pipes passing through walls and partitions. Refer to “Construction Standard - Steam and Condensate Pipe Wall Penetration” drawing.
   b. Sleeves shall be standard weight steel pipe having square cut ends with anchoring lugs welded on. Horizontal sleeves through walls and partitions shall be grouted in place and flush with finished wall faces.
   c. Size sleeves such that internal diameter is a minimum of 2" larger than O.D. of bare pipe for uninsulated lines and 2" larger than O.D. of insulation and jacket for insulated lines. Center pipes in sleeves.
   d. Lines entering buildings through sleeves shall be sealed with a high temperature link assembly placed on outside of insulation jacketing.

6. **Dielectric Connections**
   a. Pipe joints connecting copper tubing to steel or iron valves and piping shall be insulating, dielectric connections. Such joint, including dielectric material, shall be rated to withstand the temperature, pressure and other characteristics of the service for which it is to be used, including testing pressure.
   b. Screwed joints shall be made with insulating unions and couplings.
   c. Flanged joints shall be made up with flange insulation kits consisting of a suitable gasket, bolt sleeves and washers.

C. **Testing**

1. **Leakage Testing**
a. Tests shall be performed prior to cleaning, insulating, or concealing pipe. Notify Owner’s Representative 48 hours in advance of testing.

b. Prepare and keep records of each system or section of system tested. Test reports shall include, but not necessarily be limited to, the following:

1) Identification of piping system or section tested.

2) Date of test and date of Project Manager’s approval signature.

3) Testing medium and method or description of test procedure.

4) Test pressure, duration of test and recorded pressure drop.

c. Pressure tests shall apply to piping only with all equipment, traps, relief valves and instruments blocked off or disconnected. In no case shall piping or any component be subjected to pressures exceeding 90% of their published rating. All system valves within section being tested shall be open. Provide temporary restraints on expansion joints and flexible connections during pressure testing.

d. Blanks shall be furnished and installed wherever necessary to prevent cold test water from coming in contact with hot valves. Remove blanks after testing.

e. Pressure tests shall apply to piping as indicted in the following schedule. The pressure shall be gradually raised to the value given and the source then blocked off. Pressures shall be observed after the pipe and contents have stabilized at the ambient temperature and the source of test pressure shut-off. All joints shall be visually examined during test. Leaks shall be repaired and complete testing procedure repeated. Upon successful completion and approval of the tests, the piping shall be relieved of pressure, drained, and cleaned.

f. Leakage Test Schedule

<table>
<thead>
<tr>
<th>Service</th>
<th>Operating Pressure</th>
<th>Hydrostatic Test Pressure</th>
<th>Minimum Time (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam (MPS)</td>
<td>to 75</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Medium Pressure Condensate (MPC)</td>
<td>to 100</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Pumped Condensate (PC)</td>
<td>to 100</td>
<td>150</td>
<td>1</td>
</tr>
</tbody>
</table>

h. All new piping not specifically listed above shall receive an initial service leak test by gradually bringing the system up to normal operating pressure and examining for leaks.

h. On any given construction project, the Owner reserves the right to contract with an independent testing firm to complete ultrasonic shearwave weld inspections on randomly selected field welds. If the results of these tests indicate poor quality welds, those “failed” welds shall be replaced at no additional cost to the project. If further ultrasonic inspection is required to assure quality weld workmanship, these
tests shall be at the expense of the contractor, and any and all defective welds shall be replaced at no additional cost to the project.

2. Final Inspection and Adjusting
   a. After each installation is completed, tested for leaks, cleaned and approved by Owner’s Representative, it shall be filled with the fluid it is to carry. Each system shall be tested in actual operation. All valves, safety devices and equipment shall be operated and final adjustments made to place the system in operation. Such operation shall be demonstrated to the satisfaction of the Owner’s Representative.

D. Commissioning
   1. MU: Steam and condensate shall be turned on by Energy Management Utility Distribution personnel only. Owner’s Representative will coordinate.

END OF SECTION 336313
SECTION 336315 - STEAM ENERGY DISTRIBUTION PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following piping specialties for MP steam and condensate piping:

1. Strainers.
2. Steam traps.
3. Check valves.
4. Pressure Gauges.
5. Pipe Penetration Sealing Assembly.
6. Expansion Joints

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Strainers.
2. Steam traps.
3. Check valves.
4. Pressure Gauges.
5. Pipe Penetration Sealing Assembly

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For valves and steam traps to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to the following:
1. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. HP Steam Piping: 75 psig at 450 deg F.
2. Condensate Piping: 75 psig at 200 deg F.

2.2 VALVES

A. Gate, Ball, Butterfly Valves: Comply with requirements specified in Section 3363 "Steam Energy Distribution Manual Valves."

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Sizes 2” and smaller:
   a. Body: ASTM A 126, Class B forged steel, with bolted cover and bottom drain connection.
   b. End Connections: Threaded ends.
   d. Tapped blowoff plug.
   e. CWP Rating: 250-psig working steam pressure.

2. Sizes 2-1/2” through 12”:
   a. Manufacturers: Shall be model B1SC as manufactured by Armstrong International or approved equal.
   b. Body: ASTM A 126, Class B forged steel, with bolted cover and bottom drain connection.
   c. End Connections: Flanged.
   d. Strainer Screen: Stainless-steel, 0.045” perforated strainer.
   e. Tapped blowoff plug.
   f. CWP Rating: 125-psig working steam pressure.
2.4 STEAM TRAPS

A. Manufacturers: Traps shall be model 800 as manufactured by Armstrong International, or approved equal.

B. Inverted Bucket Traps:
   2. End Connections: Side inlet and outlet, threaded 3/4”.
   6. Capacity: 400 lb/hr minimum at 10 psi differential, capable of operation up to 80 psi differential.
   8. Pressure Rating: 250 psig at 450˚ F.

2.5 CHECK VALVES

A. Manufacturers: Check valves shall be model #2341 as manufactured by Powell Valves, or approved equal.
   1. Description: Class 150, Swing Check Valves with Nonmetallic Disc
   3. SWP Rating: 200 psig.
   7. Disc: PTFE.

2.6 PRESSURE GAUGES

A. Pressure gauges shall be installed as before every main line steam valve.

B. Pressure gauges shall be 1% accuracy with stainless steel movement, black phenolic or aluminum alloy case, 4-1/2" diameter dial and 1/2" NPT connection. Gauges shall be by Ashcroft, Palmer, Trierce, Weiss or Weksler.

C. Bourdon tube shall be stainless steel. All gauges shall have 1/2" carbon steel bar stock needle valve suitable for steam service.

D. Gauges used on steam service shall be protected with pigtail siphons.

E. Gauge scale range shall be as follows:
2.7 PENETRATION SEALING ASSEMBLY

A. Pipe penetration sealing assembly shall be model “T” Link-Seal Modular Seal as manufactured by PSI-ThunderLine Corporation.

B. Sealing assembly shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM:

1. For High Temperature or Fire Seal Applications (-67°F to 400°F) SILICONE = ASTM D2000 M1GE505.

2.8 EXPANSION JOINTS

A. Externally pressurized bellows expansion joints shall be model "PM" as manufactured by Adsco Manufacturing, Hyspan 3502 or Senior Flexonics Pathway.

B. Joint shall be internally/externally guided and have integral heavy cover and sleeve, and drain and vent connections. The external housing shall be designed for full line pressure.

C. Joint shall be as follows:

1. Type Single without base ends weld. Wall schedule to match pipe.
2. Bellows Type Externally pressurized, 150 psig design
3. Bellows Material 304 stainless steel or Inconel
4. Covers Integral
5. Sleeve Integral
6. Cycles 1000
   Maximum Thrust Area 148 sq. in. for 10" joint
                        84 sq. in. for 8" joint
                        22 q. in. for 6" joint
                        22 sq. in. for 3" joint
7. Maximum Axial Spring Rate: 410 lb/in for 10" joint
                              1385 lb/in for 8" joint
                              525 lb/in for 6" joint
                              674/in for 3" joint
8. Joints shall be pre-compressed at the factory for the design travel and shipped with suitable restraining devices to permit proper installation of joint in cold line. Provide for possible joint extension of at least 10% of rated travel.
9. Joints and guides shall be properly cleaned and painted with manufacturer's standard finish.
PART 3 - EXECUTION

3.1 VALVE APPLICATIONS
A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.2 PIPING INSTALLATION
A. Install piping to permit valve servicing.
B. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
C. Install valves according to Section 336317 "Steam Energy Distribution Manual Valves”.
D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
F. Install shutoff valve immediately upstream of each dielectric fitting.
G. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

3.3 STEAM-TRAP INSTALLATION
A. Install steam traps in accessible locations as close as possible to connected equipment.
B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.4 SEAL PENETRATION INSTALLATION
A. Steam and condensate pipe penetrations entering through a concrete building foundation shall be installed with a Link-Seal Modular seal assembly fitted within a stainless steel schedule 40 pipe sleeve surrounded by a masonry knock out section.
3.5 COMMISSIONING

A. Steam and condensate will be turned on by Energy Management Utility Distribution personnel. Coordinate with Owner’s Representative.

END OF SECTION 336315
SECTION 336317 – STEAM ENERGY DISTRIBUTION MANUAL VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Gate valves with threaded connections.
      2. Gate valves with flanged connections.
      4. Ball valves with threaded connections.
      5. Check valves with threaded connections.

1.3 DEFINITIONS
   A. CWP: Cold working pressure.
   B. NRS: Nonrising stem.
   C. OS&Y: Outside screw and yoke.
   D. RS: Rising stem.
   E. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of valve.

1.5 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 gate valves closed to prevent rattling.

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.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded-end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for pipe flanges and flanged fittings, NPS 1/2 through NPS 24.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B31.1 for power piping valves.
   6. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. RS Valves in Insulated Piping: With 2-inch stem extensions.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 GATE VALVES WITH THREADED CONNECTIONS

A. Class 800, OS&Y Carbon Steel Gate Valves:
1. Provide model 950 S as manufactured by Hancock or model 12111 as manufactured by Vogt or approved equal.

2. Description:
   a. Standard: MSS SP-70, Type 1.
   c. Ends: Threaded.
   e. Disc: Solid wedge; 420 stainless steel.
   f. Packing: Compressed graphite
   g. Gasket: 304 stainless steel spiral wound.
   h. Handwheel: Malleable iron.

2.3 GATE VALVES WITH WELDED CONNECTIONS

A. Class 800, OS&Y Carbon Steel Gate Valves:
   1. Provide model 950 W as manufactured by Hancock or model SW 12111 as manufactured by Vogt or approved equal.

   2. Description:
      a. Standard: MSS SP-70, Type 1.
      c. Ends: Socket Welded.
      e. Disc: Solid wedge; 420 stainless steel.
      f. Packing: Asbestos free, compressed graphite
      g. Gasket: 304 stainless steel spiral wound.
      h. Handwheel: Malleable iron.

2.4 GATE VALVES WITH FLANGED CONNECTIONS

A. Class 150, OS&Y, Carbon Steel Gate Valves:
1. Provide model 47XUF as manufactured by Crane or model 15-OF-U as manufactured by Stockham or model K150 SCL as manufactured by Kitz or approved equal.

2. Description:
   a. Standard: MSS SP-70, Type I.
   b. Body Material: ASTM A216 WCB.
   c. Ends: Flanged.
   e. Trim: Steel.
   g. Packing and Gasket: Asbestos free, graphite and soft iron.

2.5 BUTTERFLY VALVES:
1. Provide model WAK as manufactured by Adams or model Trilok as manufactured by Bray or model Torqseal as manufactured by Velan or model Tri-Con as manufactured by Zwick or approved equal.

2. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 150 psig.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   e. Seat: Laminated graphite and stainless steel valve seal.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Steel.
   h. Manual gear operator with handwheel and open/close indicator.

2.6 BALL VALVES WITH THREADED CONNECTIONS:
1. Provide model 77CLF 140-10 as manufactured by Apollo or approved equal.

2. Description:
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.7 Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:
   a. Standard: MSS SP-80, Type 4.
   b. SWP Rating: 250 psig.
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.
D. 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.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

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

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

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

1. Shutoff Service: Gate valves.

B. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

3.5 MEDIUM-PRESSURE STEAM STEAM CONDENSATE VALVE SCHEDULE (MORE THAN 15 PSIG)

A. Pipe NPS 2 and Smaller: Gate Valves, Class 800 with threaded or socket welded connections.

B. Pipe NPS 2-1/2 and Larger: Gate Valves, Class 125, OS&Y with flanged connections.

C. Butterfly valves are only allowed where indicated on plans and where space for the correct size gate valve is not present.

END OF SECTION 230523
SECTION 336319 – PIPE SUPPORTS FOR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Alignment guides and anchors for steam and condensate piping in tunnels, manholes and chases.

1.3 INFORMATIONAL SUBMITTALS
   A. Welding certificates for all welders.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE
   A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
   B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 ALIGNMENT GUIDES AND ANCHORS
   A. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder
and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

C. Support Tees and Slides

1. Hot piping shall have hot-dipped-galvanized pipe tee and slides at all support points. Tees and Slides shall be Figures 257, Type 4, as manufactured by Anvil International, North Kingstown RI or approved equal. Unless otherwise noted, slide depth shall be equal to or slightly greater than insulation thickness.

D. Pipe Guides

1. Steam and condensate piping runs shall include hot dip galvanized pipe guides where indicated on drawings. Guides shall be Figure 256, size F for 12” MPS piping, size D for 6” PC piping, as manufactured by Anvil International, North Kingstown RI or approved equal.

E. U-Bolts

1. U-bolts shall be galvanized carbon steel furnished with four finished hex nuts. U-bolts shall be Figure 137 as manufactured by Anvil International, North Kingstown RI or approved equal.
F. Hanger Rods

1. Hanger rods shall be machine threaded rods ASTM A36 or ASTM A575 with threads conforming to ANSI B1.1., Figure 140, 253 as manufactured by Anvil International, Hot Dipped Galvanized North Kingstown RI or approved equal. Minimum rod size shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Size Hanger</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; and under</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2- 1/2&quot;, 3&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;, 8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>10&quot;, 12&quot;</td>
<td>7/8&quot;</td>
</tr>
</tbody>
</table>

G. Unless otherwise shown or specified upper attachments for concrete ceilings shall be as follows:

1. Concrete single lug plate shall be Hot Dipped Galvanized Figure 47, or clevis plate Figure 49 all as manufactured by Anvil International, North Kingstown RI or approved equal or equal). Expansion anchors shall be stainless steel.

2. For pipe 4" and under (optional): Hot Dip Galvanized, drop-in type female expansion anchor.

H. Hangers

1. Hangers required for horizontal piping in manholes shall be as follows and all as manufactured by Anvil International, North Kingstown RI or approved equal:

   a. Uninsulated pipe: Adjustable clevis, Figure 260, Hot Dipped Galvanized.

   b. Insulated Pipe: Adjustable clevis, Figure 260, Hot Dipped Galvanized.

   c. Copper Pipe: Adjustable tubing ring, plastic coated, Figure CT-99C or equal).

I. Structural Steel

1. Miscellaneous structural steel, plates, etc. for pipe supports and anchors in trenches and manholes shall be ASTM A36 of sizes and shapes needed, no tubular members.

2. All structural steel members and end plates shall be hot dipped galvanized ASTM, A123.

3. Any galvanizing damaged by welding or erection shall be repaired with solder galvanizing per ASTM A780. Surface preparation shall include power disk sanding the abraded or welded area to bright metal.

4. Welding of structural steel supports and anchors shall be completed with E70XX electrodes.

J. Expansion Bolts

1. Expansion bolts and nuts used in connection with pipe support structures shall be Hot Dipped Galvanized "Kwik Bolt III" as manufactured by Hilti Inc., Tulsa OK, or approved
equal installed per manufacturer's recommendations. Minimum embedment shall be as follows:

<table>
<thead>
<tr>
<th>Bolt Diameter, in.</th>
<th>Embedment, in.</th>
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</thead>
<tbody>
<tr>
<td>1/2</td>
<td>3-1/2</td>
</tr>
<tr>
<td>5/8</td>
<td>4</td>
</tr>
<tr>
<td>3/4</td>
<td>4- ¾</td>
</tr>
<tr>
<td>1</td>
<td>4- 1/2</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.1 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install guide(s) as per detail.

C. Attach guides to pipe, and secure guides to structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. All piping shall be supported to prevent excessive stress, swaying, sagging, or vibration. Piping shall not be so restrained, however, as to cause it to snake or buckle between supports or anchors or to prevent movement due to expansion and contraction.

F. Supports shall be complete, including lock nuts, clamps, rods, bolts, couplings, swivels, inserts, required accessory items and secondary structural steel.

G. Anchor Attachments:


H. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

   1. Anchor Attachment to Steel Structural Members: Attach by welding.

   2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

I. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

J. Spacing

   1. The maximum support spacing for horizontal piping shall be as follows:
a. Steel Pipe (MPS, MPC, PC) Steam & Liquids

<table>
<thead>
<tr>
<th>Size</th>
<th>Length</th>
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<tbody>
<tr>
<td>2&quot; and under</td>
<td>6'</td>
</tr>
<tr>
<td>6&quot;, 8&quot;</td>
<td>12'</td>
</tr>
<tr>
<td>10&quot;, 12&quot;, 14&quot;, 16&quot;, 24&quot;</td>
<td>24'</td>
</tr>
</tbody>
</table>

2. Supports in chase shall be installed off the floor of chase a minimum of 2”.

K. All galvanizing shall be repaired with solder galvanizing, as per ASTM A780.

END OF SECTION 336319
SECTION 336321 – STEAM ENERGY THERMAL DISTRIBUTION INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulation requirements for steam and pumped condensate piping systems located in utility manholes, tunnels, and chases.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at pipe expansion joints for each type of insulation.
   3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   4. Detail removable insulation at piping specialties.
   5. Detail application of field-applied jackets.
   6. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Flame-spread index of 0, and smoke-developed index of 0.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required. 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

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Insulation for steam and condensate piping in trenches, tunnels and manholes shall be “Eslin” E-Glass pipe insulation as manufactured by Visionary Industrial Insulation, Kapolei, HI, or approved equal.

G. Insulation fabrication adhesive shall be Hydrocal B-11 as manufactured by USG Corporation, Chicago IL, or approved equal.

H. Insulation shall have bore coat of Hydrocal B-11 as manufactured by USG Corporation, Chicago IL, or approved equal.

I. All piping insulation in manholes, trench and tunnel shall be covered with 0.024" thick, stucco embossed, perforated aluminum jacket, aluminum alloy. ASTM B209 with H-14 temper, 1/8" diameter holes on 21/64" staggered centers. Covering shall be Insul-Mate as manufactured by RPR Products, Inc., Houston TX, or approved equal. Fittings shall be covered with 0.016" perforated aluminum jackets.

J. Flanged valves, expansion joints and steam meters shall be insulated with tight fitting, reusable insulation blankets consisting of high density insulation (fiberglass, mineral wool, ceramic fiber) covered on outside with coated glass fabric having heavy adjustable straps with buckles. Inside of blanket shall be covered with fabric suitable to specified temperature or stainless steel square mesh woven wire cloth. Insulation shall be minimum 1-1/2” thick. Blankets shall be suitable for temperatures up to 500°F. Install Velcro sealed “inspection window” for expansion covers to allow maintenance personnel the ability to inspect for proper movement of the expansion joint slip.

2.2 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Surface Preparation: Clean and prepare surfaces to be insulated as described by manufacturer’s recommendations.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements and adhesives with clean potable water.

3.3 INSTALLATION

A. All required tests on piping must be completed and satisfactory test reports must be completed prior to application of insulation covering joints.

B. All surfaces to be insulated shall be cleaned of all scale, rust, oil, and foreign matter and shall be dry and free of frost prior to and during application of insulation.

C. All insulation and accessory materials shall be stored in an area that is dry and protected from the weather before and during insulation application.

D. Insulation shall be installed to accept cyclic thermal growth and contraction of piping without damage and loss of insulating value.

E. Insulation systems shall be installed in strict accordance with manufacturer's recommendations and as detailed on drawings “Construction Standard - Expansion Joint Insulation Detail” and “Construction Standard - Pipe Guide Insulation”.

F. Reinsulate any existing steam and condensate piping that are to remain that had insulation removed as part of asbestos abatement work or to make tie-ins.

G. Insulation shall be applied to pipe, fittings, flanges and valves. Unions shall not be insulated. Trap installations to include traps, stop valves, check valve, and hand-blow valve, shall not be
insulated. Piping on trap installations shall be insulated. Drip leg and piping up to first stop valve shall be insulated.

H. Insulation shall be installed in a smooth, clean, workmanlike manner. Joints shall be tight and finished smooth. Stagger longitudinal joints and tightly butt sections.

I. Insulation shall fit tightly against surface to which it is applied.

J. Apply insulation so as to permit expansion or contraction of pipe lines without causing damage to insulation.

K. Preformed pipe covering shall be terminated at a sufficient distance from flanges to permit removal of bolts.

L. Insulation on flanges and flanged fittings shall overlap adjacent pipe covering at least 2".

M. Pipe insulation at expansion joints shall be held back a sufficient distance to permit the specified travel into the joint.

N. Valves shall be insulated up to the gland only so as to permit replacement of packing without disturbing insulation.

O. Insulation shall be continuous through pipe covering protection saddles, guides and sleeves or openings in walls and floors. Aluminum jacket shall not be run through pipe saddles and guides.

P. Lap jacket 2" and fasten with 1/2" stainless steel bands on 12" centers.

Q. Provide band 1-1/2" back from all discontinuous ends of jacket.

R. All insulation shall be marked non asbestos.

3.4 PENETRATIONS

A. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

B. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof
3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

B. Steam Condensate, 200 Deg F:
   1. NPS 2 and Larger: Insulation shall be the following:
      a. 1.5 inches thick.

C. Steam, above 450 Deg F:
   1. NPS 6 through NPS 12: Insulation shall be the following:
      a. 3 inches thick.
   2. NPS 4: Insulation shall be the following:
      a. 2.5 inches thick.
   3. NPS 3: Insulation shall be the following:
      a. 2 inches thick.

D. Flanged valves, expansion joints and steam meters shall be insulated with tight fitting, reusable insulation blankets consisting of high density insulation (fiberglass, mineral wool, ceramic fiber) covered on outside with coated glass fabric having heavy adjustable straps with buckles. Inside of blanket shall be covered with fabric suitable to specified temperature or stainless steel square mesh woven wire cloth. Insulation shall be minimum 1-1/2" thick. Blankets shall be suitable for temperatures up to 500°F. Install Velcro sealed “inspection window” for expansion covers to allow maintenance personnel the ability to inspect for proper movement of the expansion joint slip.

3.8 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material.
B. If more than one material is listed, selection from materials listed is Contractor's option.

C. All Piping described in this sections:
   1. Aluminum, perforated: 0.024 inch thick.

D. All Fittings described in this sections:
   1. Aluminum, 0.016 inch thick.

3.9 Commissioning
   A. Steam and condensate lines will not be placed in service until all insulation has been installed.

END OF SECTION 336321
SECTION 336333 - STEAM ENERGY DISTRIBUTION METERING

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of steam revenue metering.

1.1 DESIGN GUIDELINES:

A. Materials

1. General: Owner will provide steam flow meters, flow computer, pressure transmitter and RTD for contractor installation. Refer to drawings for installation requirements.
2. The University of Missouri Columbia has standardized on FSS Swirl Flowmeters as manufactured by ABB Inc., Warminster, PA and Supertrol II flow computers as manufactured by KEP Inc., Eaton Town, NJ. Substitutes will not be accepted.
3. As these meters will be used to measure building steam usage for utility billing purposes, the meter shall be carefully sized considering the design of the building envelope, HVAC and process equipment, projected building utilization and diversification. Consultant is to provide Project Manager with GSF of facility and a steam usage estimate. All capacities and selections must be verified with ABB and approved by the Project Manager before completing final selection.
4. Steam Meter
   a. Meter shall be Swirl Flowmeter Model FSS430Y0R1F0(____)R0A1A1B1H5L2SP0R5TC1M5. No substitutions accepted.
5. Flow Computer
   a. KEP Flow computer model ES749O1(3-MOD-IP)P without enclosure. No substitutions accepted.
6. Pressure Transmitter
   a. ABB Model 261GSDKBNS1 pressure transmitter or approved equal. Pressure range 0-145 psig. Process temperature range of -58 to 248 °F. ½” NPT process connection. Pressure transmitter shall have ½” pigtail siphon and ½” forged steel gate valves before and after installed pigtail siphon.
   b. Pressure transmitter shall have ½” pigtail siphon and ½” forged steel gate valves before and after installed pigtail siphon.
7. RTD
   a. ABB Model V10186-LT2T (____) 3S3A10 or approved equal. RTD assembly shall include a spring loaded, three-wire platinum 100 ohm RTD. Aluminum connection head, 316 stainless steel union and nipple inserted into a 316 stainless steel thermowell. Process connection shall be ¼” NPT.
B. Installation

1. Installation of steam meter and associated wiring, pressure transmitter and RTD assembly, shall be in strict accordance with manufacturer’s printed instructions and recommendations, applicable BOCA requirements, and as detailed on drawings.

2. Swirl meters shall be installed in a horizontal position with a minimum of five straight pipe diameters upstream and five straight pipe diameters downstream. Meter head shall be installed in the horizontal plane or facing down as detailed in instructions for high temperature applications.

3. Swirl meter shall be installed prior to all steam pressure reducing valves and modulating control valves.

4. Swirl meter transmitter shall be located in an accessible location to permit ease of reading and service of transmitter.

5. Low-voltage wiring to the steam meter and flow computer shall be made in coordination with Owner’s Representative as shown in 336333 ABB Swirl Meter Wiring Diagram.dwg.

C. Commissioning

1. The final wiring connections to the swirl meter, pressure transmitter and RTD will be made by Owner.

2. Steam will not be turned on by Owner until the steam meter is fully installed and operating satisfactorily and the downstream steam piping is successfully leak tested and secure.

3. Only Owner personnel will be authorized to turn steam service on or off.

D. REFERENCES

1. 336333 ABB Swirl Meter Wiring Diagram dwg.

END OF SECTION 336333
SECTION 336340 - STEAM MANHOLES AND STRUCTURES

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of steam manholes.

1.1 DESIGN GUIDELINES:

A. General

1. All new manholes shall be fully dimensioned, and designed so as to contain that which is intended with additional room provided for accessibility to mechanical and electrical equipment, operation of equipment, accessibility for construction and future maintenance, including removal and replacement of valves and expansion joints. Work space allowance shall take into account insulation on lines.

2. Internal dimensions of steam manholes should never be smaller than 6’ wide x 6’ long x 7’ high. Manhole shall have 12” minimum clearance from any pipe or piece of maintainable equipment to the top, bottom or side of manhole.

3. Manhole entry locations shall be coordinated to allow for full access to equipment and maintenance spaces.

4. All manholes shall have ladders. Manhole entry shall not be located in streets where possible.

5. Outside surfaces of all sub grade walls, roof and risers of new manholes shall be waterproofed as described in Section 336354 General Concrete Requirements – Waterproofing.

6. Manhole shall be made with reinforced concrete with smooth surfaces either cast or precast.

7. Manhole shall be vented by two openings: a 6” diameter vertical pipe installed outside of the manhole entering the manhole 6” off the floor, and a 6” diameter vent in manhole top. See drawing: “Construction Standard – Manhole Vent Detail.”

8. Manholes shall have means of removing water either by gravity drain to daylight or storm sewer, or by mechanical pumping.

9. Sump pits for mechanical pumps shall have internal dimensions of 24” x 24” x 24”.

10. Structural Steel and Anchor Bolts

   a. Miscellaneous structural steel, plates, etc. for pipe supports, guides and anchors in manholes shall be ASTM A36 of sizes and shapes needed. No tubular structural members allowed.
b. All structural steel members and end plates shall be hot dipped galvanized. Any galvanizing damaged by welding or erection shall be cleaned, heated and repaired with lead free galvanized self-fluxing repair solder. Surface preparation shall include power disk sanding the abraded or welded area to bright metal and heating to 600 degrees F.

c. Miscellaneous plates and pipe used for supports/anchors shall be hot dipped galvanized. 304 Stainless steel is an acceptable alternative for small support members, in lieu of HDG steel.

d. Expansion bolts and nuts used in connection with pipe support structures shall be hot dipped galvanized, "Kwik Bolt III" as manufactured by Hilti Inc., Tulsa OK, approved equal. All are to be installed per manufacturer's written instructions.

11. Electrical Requirements

   a. An electric service shall be provided for any manhole with a sump pump.

   b. Aluminum conduit and XHHW wire shall be used for feeding receptacles and junction boxes, and galvanized steel receptacle boxes with stainless steel covers shall be used. See drawing: “Construction Standard – Sump Pump Installation.”

   c. Use NEMA 4X stainless steel junction boxes with stainless steel inner back panel and hinged gasketed door with “fast-operating” stainless steel clamps. Box shall be mounted to manhole wall on hot-dipped galvanized steel u-channel supports.

B. Installation

1. Formwork shall be constructed such that the finished concrete surfaces are free of any abrupt dimensional changes requiring extensive corrective work such as patching or grinding and that formed concrete will conform to dimensional tolerances. Steam System Anchor blocks for manholes. Steam thrust anchor block shall be poured integral to floor. Minimum 12” tall and 12” either side of base plate. hot dipped galvanized base plate to be cast into anchor block.

2. All rebar shall be covered with at least 2” concrete cover.

3. All manholes should be deep enough such that they can be waterproofed and covered with protective hardboard cover before landscaping is restored, or concrete sidewalks or drives are poured.

4. Do not install manhole in area where run off water will be routed in to manhole.

5. Welding and Brazing

   a. All welding, brazing, soldering and cutting work shall conform to applicable provisions of the following codes and requirements:

2) American Welding Society (AWS) D1.1 (latest) Structural Welding Code

b. Welding and brazing shall be performed only by skilled welders. Welders, and welding and brazing procedures shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. A record shall be maintained on the job showing the date and results of qualification test for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's Representative.

C. Commissioning

1. Energy Management shall approve all finished work on the installation of manhole accessories.

2. All manholes shall be cleaned of all dirt, debris, insulation, welding rods, etc. and inspected by Owner's Representative before put in to service.

END OF SECTION 336340
PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of manhole accessories.

1.1 DESIGN GUIDELINES:

A. Materials

1. Covers and Frames

   a. Manhole cover and frame shall be 36", black, Fiberlite composite cover with gasket and frame. Frame shall be set in concrete per manufacturer’s instructions.

   b. Vent cover and frame shall be 8-1/2” clear opening, cast iron, heavy duty, Neenah R-5901-A with open grate.

2. Ladders

   a. Ladders shall be welded carbon steel, hot dipped galvanized per ASTM A123 (minimum 2 oz./sq. ft.)

   b. Rails shall be 2-1/2" x 1/2" bars. Rails shall be 18" apart.

   c. Rungs shall be 3/4" diameter deformed reinforcing bars, ASTM A615, Grade 40, on 12" centers. Rungs shall be set in holes drilled in rails and welded in place. Through holes shall be plug welded and ground smooth.

   d. Ladder shall have minimum clearance of 7" between vertical mounting surfaces and center of rung.

   e. Side rails shall be fastened at the top and bottom with galvanized angle brackets fastened to the concrete with 1/2" (minimum) stainless steel expansion anchors.

   f. Ladders with 20’ vertical length or greater shall be equipped with a safety cage designed, fabricated and installed in accordance with OSHA requirements.

END OF SECTION 336341
SECTION 336344 - STEAM AND CONDENSATE CHASE

PART 1 - GENERAL:

The scope of this document is to provide instruction for the installation of concrete steam chase.

1.1 DESIGN GUIDELINES:

A. General:

1. All steam and condensate pipe hangers, supports, guides and anchors shall be designed and properly located in drawings. The types of hangers, supports, guides and anchors to be used at each point along the piping shall be specified and detailed. See “Construction Standards – Pipe Supports”.

2. The internal dimensions of the chase shall be designed to enclose the necessary equipment, allow for sufficient space for personnel to maintain, repair or replace equipment. No flanges, screwed piping, expansion joints, steam traps, main taps, or valves are allowed in chase.

3. All pipe supports and anchors placed in chase shall have a minimum clearance of 1” between the support or anchor and the chase floor, to allow drainage in chase.

4. Chase shall be made with reinforced concrete with smooth surfaces either cast in place or precast. See drawing: “Construction Standard - Typical Chase Structure”.

5. Outside surfaces of all subgrade walls, and roofs of new chases shall be waterproofed as described in Section 336354 “General Concrete Requirements – Waterproofing” and detail “Steam Chase Waterproofing.”

6. Pipes entering a building from a chase shall be sealed with a high temperature link seal at the building penetration. Chases shall be vented near the building with a 4” diameter pipe. The top of vent shall be 1’ above final grade and “mushroom” type vent cap. See “Construction Standards – Piping Specialties”.

7. Chase entering a manhole shall have a clear opening the internal dimensions of the chase to allow visual inspection of piping in the chase from the manhole.

8. Chase shall be sloped away from the building. If not possible, a manhole will be needed next to the building.

B. Materials

1. Structural Steel and Anchor Bolts

   a. Miscellaneous structural steel, plates, etc. for pipe supports, guides and anchors in chase shall be ASTM A36 of sizes and shapes needed. No tubular steel members.

   b. All structural steel members and end plates shall be hot dipped galvanized.
c. Any galvanizing damaged by welding or erection shall be repaired with cold galvanizing, as per ASTM A780. Surface preparation shall include power disk sanding the abraded or welded area to bright metal.

d. Expansion bolts and nuts used in connection with pipe support structures shall be Hot Dip Galvanized, "Kwik Bolt III" as manufactured by Hilti Inc., Tulsa OK, approved equal. All are to be installed per manufacturer's written instructions.

C. Installation

1. Formwork shall be constructed such that the finished concrete surfaces are free of any abrupt dimensional changes requiring extensive corrective work such as patching or grinding and that formed concrete will conform to dimensional tolerances.

2. All rebar shall be covered with at least 2” concrete cover.

3. All chases should be deep enough such that they can be waterproofed and covered with protective hardboard before landscaping is restored, or concrete sidewalks or drives are poured.

4. Welding and Brazing
   a. All welding, brazing, soldering and cutting work shall conform to applicable provisions of the following codes and requirements:
      2) American Welding Society (AWS) D1.1 (latest) Structural Welding Code
   b. Welding and brazing shall be performed only by skilled welders. Welders, and welding and brazing procedures shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. A record shall be maintained on the job showing the date and results of qualification test for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's Representative.

D. Commissioning

1. Owner’s Representative shall approve all finished work on the installation of the chase.

2. All pipe trenches shall be cleaned of all dirt, debris, insulation, welding rods, etc. and inspected by Owner's Representative before placing lids on trench.
E. References

1. Section 336354 “General Concrete Requirements – Waterproofing”, section 336351 “Concrete Requirements – Concrete Formwork” and detail “Steam Chase Waterproofing.”

END OF SECTION 336344
SECTION 336345 - PRECAST CONCRETE UTILITY STRUCTURES - LIDS

PART 1 - GENERAL:

The scope of this document is to provide instruction for the installation of precast trench and chase lids

1.1 DESIGN GUIDELINES:

A. General

1. For existing pipe trench lids, all field dimensions required to insure proper fit of new lids on existing trench shall be obtained.

2. Precast concrete lids shall be manufactured by a recognized supplier of precast concrete products having at least 3 years successful experience in the fabrication of similar precast units.

3. Allowable Tolerances
   a. Lids shall be manufactured to comply with the following dimensional requirements.
      1) Warpage: One corner out of plane of other three (1 in 200) from nearest adjacent corner.
      2) Bowing: (Length of Bow/360) to maximum of 3/4".
      3) Overall length and width: Plus or minus 1/8".
      4) Thickness: Plus 1/4", minus 1/8".
      5) Deviation from square:
         a) In any length: (1 in 600).
         b) Maximum: 1/4".

4. Design Criteria
   a. Lids shall be constructed per drawing “Design Standard – Typical Chase Structure” and in compliance with the latest revision of American Concrete Institute ACI 318.
   b. Provide any additional reinforcing as required for stripping forms and erecting lids.
   c. All reinforcement bars shall be fabricated with ChromX 9100 steel.
   d. Maximum lid length shall be ten (10) feet.
e. Work shall be laid out at the site in order to determine the number and exact length of lids required

5. Lifting Provisions
   a. Provide lifting system for lids to include sling complete with spreader bar, cables, brackets, hardware, etc.
   b. Lids shall have suitable underside recesses at each corner (4 per lid) where the brackets attach. See Drawing, “Design Standard – Typical Chase Structure”.

6. Molds
   a. Molds shall be constructed to conform to the shape and dimension of the lids as shown on the Drawings and to maintain the tolerances as specified.
   b. Molds shall be designed to prevent damage to concrete from:
      1) Restraint as concrete shrinks.
      2) The stripping operation when panel is lifted from mold.
   c. Joints in molds shall be so constructed and filled so they do not appear on the finished product.
   d. Wood molds shall be treated to prevent excessive absorption which would cause a non-uniform finish.

7. Finish
   a. Lids for underground trench/tunnel require no special finish.

8. Manufacture
   a. Refer to Section 336350 “Cast in Place Concrete for Utilities” for compliance.
   b. Molds shall be free from stains, rust, dirt, etc., which will cause discoloration or damage to the lids.
   c. Transporting, placing and consolidation of concrete shall be by a method to prevent segregation of concrete materials and displacement of inserts and reinforcing.
   d. Place and secure in forms all inserts, lifting devices, reinforcing and other devices and accessories required for handling and structural requirements. Reinforcing shall have concrete cover as shown on the Drawings.
9. Curing
   a. Initial curing shall take place in molds at temperature above 50˚ F with protection to precast units to prevent loss of moisture. Maximum curing temperatures shall be 150˚ F. Curing temperatures shall be uniform without localized hot areas.
   b. Initial curing shall continue until concrete reaches a compressive strength of 2500 psi.
   c. Care shall be taken to prevent covers from causing staining or discoloration of the lids from covers or condensation.
   d. Curing methods shall be uniform from lid to lid.
   e. After removal from forms, lids shall be protected from excessive evaporation and from freezing.
   f. The use of curing compounds will not be permitted.

B. Installation
   1. Delivery, Handling and Storing
      a. Deliver precast units to project site in such quantities and at such times to assure continuity of installation.
      b. Lids shall be handled and stored in such a manner as to prevent structural damage, detrimental cracking, distortion or architectural impairment.
   2. Prior to waterproofing, lids shall be shimmed, with 4 inch plastic shim pack materials, to prevent lid rocking during backfilling.
   3. Precast lids shall be carefully placed and fitted upon chase, aligned, centered between walls, and laid end-to-end minimizing joint thickness as much as possible. Once installation of lids is completed, placement of waterproofing shall be performed. See Construction Standard – Joint Sealants and Construction Standard – Waterproofing

C. Inspection and Quality Control
   1. Lids having broken corners or edges, spalls, cracks or other defects shall not be installed
   2. Hair cracks (surface cracks) visible to the eye but not measurable are acceptable. Cleavage cracks (cracks that penetrate at least to the reinforcing steel) and fractures are not acceptable

D. Commissioning
   1. Owner’s Representative shall determine whether each precast concrete lid is acceptable.
E. REFERENCES:

1. Reference shall be made to other sections of the Construction Standards for related work as follows:

   a. Concrete Reinforcement.
   
   b. Cast-In-Place Concrete

END OF SECTION 336345
SECTION 336350 - CAST-IN-PLACE CONCRETE FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete for tunnel walls and slabs; steam manholes, chases, precast items and other miscellaneous structures; control, expansion and contraction joint devices associated with concrete work.

1.2 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.
B. ACI 302 - Concrete Floor and Slab Construction.
C. ACI 304R - Measuring, Mixing, Transporting and Placing Concrete.
D. ACI 305R - Hot Weather Concreting.
E. ACI 306.1 - Cold Weather Concreting.
F. ACI 308 - Curing Concrete.
G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
H. ASTM C 33 - Concrete Aggregates.
I. ASTM C 94 - Ready-Mixed Concrete.
J. ASTM C 150 - Portland Cement.
K. ASTM C157 – Change of Hardened Hydraulic-Cement Mortar and Concrete
L. ASTM C 260 - Air Entraining Admixtures for Concrete.
M. ASTM C 295 – Guide for Petrographic Examination of Aggregates for Concrete.
N. ASTM C457 – Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
O. ASTM C 494 - Chemicals Admixtures for Concrete.
P. ASTM C 595M - Blended Hydraulic Cements (Metric).
Q. ASTM C 618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
R. ASTM C 989 – Ground Granulated Blast-Furnace Slag for use in Concrete and Mortar

S. ASTM D 994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).

T. ASTM C 1017 - Chemical Admixtures for Use in Producing Flowing Concrete.


V. ASTM C 1202 – Electrical Indication of Concrete’s Ability to Resist Chloride Ion Penetration

W. ASTM C 1240 – Silica Fume Used in Cementitious Mixtures

X. ASTM C 1260 – Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

Y. ASTM D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

Z. ASTM C 1567 – Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar Bar Method)

AA. ASTM D 6690 - Concrete Joint Sealer, Hot-Poured Elastic Type.

1.3 SUBMITTALS

A. Product Data: Submit data for bonding agent, joint devices, and attachment accessories.

B. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent work.

C. Material Certificates: Submit mill certificates for the cement, supplementary cementitious materials, and admixtures intended for inclusion in the concrete mixtures.

1. Cement: Submit certification of compliance with ASTM C 150 for cement manufactured within 3 months of submittal date.

2. Fly Ash and Pozzolan: Submit certification of compliance with ASTM C 618 performed within 6 months of submittal date.

3. Ground Granulated Blast-Furnace Slag: Submit certification of compliance with ASTM C 989 performed within 6 months of submittal date.

4. Silica Fume: Submit certification of compliance with ASTM C 1240 performed within 6 months of submittal date.

5. Chemical Admixtures: Submit certificate of compliance with ASTM C 494 Level 1 or Level 2, performed within one year of the submittal date. If a chemical admixture does not fit into a defined C 494 type, admixture certificate shall provide documentation that the admixture has no detrimental effect on strength development, time of setting, shrinkage, air entrainment, scaling, and freeze-thaw resistance (ASTM C 666 Procedure A).
D. Project Record Documents:

1. Accurately record actual locations of embedded utilities and components that are concealed from view.
2. Submit upon request for record copies of all concrete delivery tickets.
3. Submit upon request for record copy of plan with locations and dates for concrete placements shown on drawing.

E. Aggregates: Submit test results for each aggregate intended for use in the concrete mixtures, showing conformance to ASTM C 33 and additional requirements as follows:

1. Aggregate source and identification
2. Maximum nominal aggregate size, or gradation size number.
3. Gradation analysis, including percentage retained and passing each sieve, and a graph of individual percentage retained versus sieve size.
4. Quantity and identification of deleterious substances in the aggregates
   a. The limits for deleterious materials contained in coarse aggregate as defined in ASTM C 33 – Table 3 Class 4S.
5. ASTM C 1260 test report performed within 6 months of the submittal date with the following modifications.
   a. Expansion limit shall be 0.1% at 28 days in 1 N NaOH soak solution.
   b. Measure mortar bar expansion at 3 to 4 day intervals.
   c. Aggregates that exceed the 0.1% expansion limit may be used with ASR mitigation. ASR mitigation options include cement replacement with fly ash/slag/silica fume or addition of lithium nitrate admixture. The combination of reactive aggregate and cementitious materials and/or lithium nitrate admixture must be tested in accordance with ASTM C1567 and have an expansion not exceeding 0.1% at 28 days.

Note:
It is recommended to prepare ASTM C 1567 tests over a range of supplementary cementitious material replacement levels to identify the appropriate combination for mitigation.

1) If 30% lithium nitrate admixture is used to mitigate ASR expansion, the minimum lithium admixture dose shall be determined by ASTM C 1567 tests performed at three or more dose levels, one of which will be a 100% dose. The 100% dose is defined as 0.55 gallons of admixture per pound of sodium equivalent in the Portland cement. For cement with 1% sodium equivalent, the 100% dose of 30% lithium nitrate admixture is 0.0455 mL/gram of cement.

2) If 30% lithium nitrate admixture is used to mitigate ASR expansion, the ASTM C 1567 soak solution shall be 1 N NaOH containing lithium nitrate
admixture in proportion to the dose added to the mortar. For the 100% dose of 30% lithium nitrate admixture, use 71 mL of admixture per liter of soak solution.

6. Submit complete data regarding concrete aggregates prior to any change in aggregate source.

F. Concrete Mixture Submittal: At least 30 days minimum prior to concrete placement, submit mixture proportions and prequalification test data for each type of concrete along with material certifications. Submit complete list of ingredients including type, brand, source and amount of: cement, fly ash, silica fume, ground granulated blast-furnace slag, aggregates, and admixtures.

G. Prequalification of Concrete Mixtures: Provide test data for each class of concrete meeting the performance requirements for each class of concrete required in Section 3.9.

1. Laboratory Qualifications: Prequalification testing shall be performed by a laboratory selected or approved by the Owner’s Representative.

2. Submit copies of testing reports showing the concrete mixture has been successfully tested to produce the properties specified and that the mix will be suitable for the job conditions. The laboratory tests shall include mill certificates and other test data for all cementitious materials, aggregates, and admixtures required by this specification. Materials used in the trial mixtures shall have the same source as proposed for use on the project. If source material changes, resubmit mixture data using revised source material, unless approved in writing by the Owner’s Representative.

3. No concrete shall be placed unless proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Owner’s Representative.

4. The submittal shall clearly indicate the concrete producer’s mixture identification name or code, the class of concrete, and intended use.

5. Prequalification criteria are as follows. Specification limit values for each class of concrete are listed in Table 1.

a. Report trial mixture proportions, slump, air content, unit weight, and mixture temperature.

b. ASTM C 39 – Submit compressive strength development of the trial mixture from at least two cylinders tested at 3, 7, 28, and 56 days age. Tests may be performed on either 6-inch diameter or 4-inch diameter standard concrete cylinders.

c. ASTM C 39 - Provide documentation for establishing the required average strength, $f_{c'}$.

1) If available, submit test data for 30 individual batches of production concrete tested at 28 days age. Determine the mean and standard deviation, $s$. Calculate the required average strength of concrete from the specified strength,
2) In the absence of historical data, calculate the required average strength as follows
\[ f'_{cr} = f'_{c} + 1.34s \text{ [psi]} \]

2) In the absence of historical data, calculate the required average strength as follows
\[ f'_{cr} = f'_{c} + 1200 \text{ [psi]} \]

d. ASTM C1152 – Acid-soluble chloride ion content of the concrete mixture shall not exceed 0.20 percent of the mass of cement. Report the average of two tests taken from the trial concrete mixture. Obtain a representative sample of concrete by cutting and pulverizing a disk from the center of a cylinder that is at least as thick as the maximum aggregate size.

e. ASTM C 457 – Submit test report for the hardened air content and air-void system parameters of the trial concrete mixture when required in Table 1. The minimum acceptable hardened air content shall be identified in Table 1. The maximum acceptable air-void spacing factor shall be 0.008 inches. The minimum acceptable specific surface shall be 600 in²/in³.

f. ASTM C 1202 – Submit test results for three cylinders tested at 28 days when required in Table 1. Moist cure test cylinders in a water bath held at 73 (± 3) degrees Fahrenheit for seven days followed by 100 (± 3) degrees Fahrenheit for 21 days prior to test.

g. ASTM C 157 – Submit test results for 28 day drying shrinkage as the average of three specimens in accordance with ASTM C 157 and the following modifications when required in Table 1.

1) Record and report the initial length upon removal from the mold as described in ASTM C 157, then cure test specimens in 73 (± 3) degree F lime water for 7 days followed by air storage in standard conditions. (73 ± 3 F and 50% ± 4% RH)

2) Record and report drying shrinkage measurements weekly.

3) Calculate the drying shrinkage as the difference between the length of the specimen upon removal from curing and the length measured in air storage expressed as a percentage of the length measured upon removal from curing at eight days age.

4) For maximum coarse aggregate size ≤ 1 inch, specimens shall be 3-in by 3-in by 11.25-in prisms with a 10-inch gage length. For larger aggregate, use a minimum specimen dimension that is at least 3 times the maximum aggregate size.

5) If the concrete mixture drying shrinkage at 28 days exceeds the limit listed in Table 1, mixture proportions shall be adjusted, or a shrinkage reducing admixture shall be incorporated into the mixture.
H. Silica Fume Manufacturer’s Representative: Submit statement that silica fume manufacturer’s representative will be present at mix plant to ensure proper mix, including high range water reducer, superplasticizer, and batching methods during the first 3 days of concrete mix preparation and placement. After which, manufacturer’s representative will designate representative at concrete producer’s plant to ensure concrete mix procedures meet silica fume manufacturer’s recommendations. Silica fume manufacturer’s representative shall attend and advise at placement and finishing of initial phases of tunnel construction.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cementitious materials and aggregate from same source contained in the submittals for all Work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. A preconstruction meeting shall be held with concrete supplier, contractor, finisher, admixture supplier(s) and Owner’s Representative. A sample pour shall be performed with each of the proposed concrete mixes to verify methods of placing, finishing and curing to ensure concrete quality. Test cylinders may be cast for the sample pour at the discretion of the Owners Representative.

1.5 COORDINATION

A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type II


C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C 260.
B. Chemical: ASTM C 494, Type A - Water Reducing, Type B – Retarding, Type C – Accelerating, Type F - Water Reducing, High Range.

C. Fly Ash and Calcined Pozzolan: ASTM C 618.

D. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 80, 100 or 120

E. Plasticizing: ASTM C 1017.

F. Silica Fume: ASTM C 1240

2.3 ACCESSORIES

A. Bonding Agent: Polymer resin emulsion or Latex emulsion.

B. Non-Shrink Grout: ASTM C 1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 pounds per square inch in 48 hours and 5,000 pounds per square inch in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D 1752; closed cell molded vinyl foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

2.5 CONCRETE MIX

A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C 94.

B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.

C. Optimize the combined aggregate gradation to minimize the paste content required to make workable concrete.

D. Use accelerating admixtures in cold weather only when approved by Owner’s Representative. Use of admixtures will not relax cold weather placement requirements.

E. Admixtures containing ingredients corrosive to reinforcing steel such as chloride ion, bromide ion, or thiocyanate are not permitted.

F. Use set retarding admixtures during hot weather only when approved by the Owners Representative.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete surfaces by abrasive blast cleaning, to remove debris and laitance and expose aggregate. Thoroughly wet the substrate prior to placement of fresh concrete against prepared surface.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels in an approved epoxy or adhesive.

3.3 PLACING CONCRETE

A. Place and consolidate concrete in accordance with ACI 301 and ACI 318.

B. Notify Owner’s Representative and testing agency minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Place concrete continuously between predetermined expansion, control, and construction joints.

F. Do not interrupt successive placement; do not permit cold joints to occur.

3.4 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure concrete floor surfaces to requirements of Section 03390.

D. Remove any curing materials containing waxes or other products that may interfere with adhesion of waterproofing membrane installed under Section 07132 and 07140.
3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 by ACI certified technicians.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

D. Concrete for casting test specimens and fresh concrete properties shall be sampled at the end of the chute in accordance with ASTM C 172.

E. No water other than the incidental water used to prewet the delivery chute and fins shall be added to the concrete after the truck leaves the batch plant, unless directed in writing by the Owners Representative.

F. Adjustment of slump on site shall only be accomplished by the addition of water reducing or plasticizing admixture. Admixture shall be placed directly onto the concrete and the revolving drum mixer shall mix at high speed for 5 minutes, or 100 revolutions, before discharge.

G. Obtain concrete for casting test samples after slump adjustment.

H. Tests for fresh concrete properties (slump ASTM C 143, air content ASTM C 231, temperature ASTM C 1064, and unit weight ASTM C 138) shall be performed whenever casting test cylinders.

I. One additional slump test will be taken at the point of pump discharge for each set of test cylinders taken.

J. Additional fresh concrete property tests shall be performed when requested by the Owners Representative.

K. Six concrete test cylinders (6-in dia. x 12-in) will be cast for each placement, or for every 75 cubic yards, whichever is greater, for each class of concrete placed. Compressive strength of test cylinders shall be determined as follows:

1. One cylinder shall be tested at 3 days

2. One cylinder shall be tested at 7 days

3. Two cylinders shall be tested at 28 days

4. One cylinder shall be tested at 56 days,

5. One extra cylinder will be cast for discretionary use

L. Two additional test cylinders shall be cast during cold weather concreting and shall be cured on the job site under the same conditions as the concrete it represents. Compressive strength of field cured cylinders shall be determined prior to form removal, and at 56 days age.
M. Two concrete test cylinders (preferably 4-in dia. x 8-in) will be cast for ASTM C 1202 quality assurance testing for every 500 cubic yards, or portion thereof. ASTM C 1202 cylinders shall be cured in the same manner as the prequalification test cylinders.

3.6 PATCHING
A. Allow Owner’s Representative to inspect concrete surfaces immediately upon removal of forms.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Owner’s Representative upon discovery.
C. Patch imperfections in accordance with ACI 301.

3.7 DEFECTIVE CONCRETE
A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
B. Remedy for defective concrete (payment penalty, repair, or replacement) will be determined by Owner’s Representative.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Owner’s Representative for each individual area. Repairs made shall be in accordance with ACI 301.

3.8 SCHEDULE - CONCRETE TYPES AND TEST REQUIREMENTS
A. Class A concrete shall include concrete for tunnels, chases, vaults, manholes and other tunnel system components:
B. Class B concrete shall include concrete for retaining walls, power plant slabs on grade, exterior stairs, ramps, and other miscellaneous structures:
C. Class C concrete shall include concrete for flowable fill for backfill at overexcavation in rock:
### Table 1 – Concrete Proportioning and Testing Requirements

<table>
<thead>
<tr>
<th>Concrete Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials and Proportions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement, ASTM C 150</td>
<td>Type I/II</td>
<td>Type I/II</td>
<td>Type I/II</td>
</tr>
<tr>
<td>Supplementary Cementitious Materials, $cm$</td>
<td>50% max †</td>
<td>50% max †</td>
<td>No limit</td>
</tr>
<tr>
<td>Maximum Aggregate Size</td>
<td>1 inch</td>
<td>1 inch</td>
<td>3/8-inch</td>
</tr>
<tr>
<td>Water-cementitious materials ratio, $w/cm$</td>
<td>0.40 max</td>
<td>0.40 max</td>
<td>No limit</td>
</tr>
</tbody>
</table>

| **Prequalification Requirements**    |                          |                          |                          |
| Aggregates                          | ASTM C 1260              | ASTM C 1260              | >8 in.                   |
| Slump - ASTM C 143                  | 6 to 8 in.               | >6 in.                   | Not required             |
| Chloride Content – ASTM C 1152      | < 0.20% wt of cement     | < 0.20% wt of cement     | Not required             |
| Air Content - ASTM C 231            | Not required             | 5.5% to 7.5%             | Not required             |
| Hardened Air Content - ASTM C 457   | Not required             | > 5%                     | Not required             |
| 28 day Strength - ASTM C 39         | $f_c' = 5000$psi         | $f_c' = 4500$psi         | $f_c' = 700$psi          |
| Drying Shrinkage - ASTM C 157       | $\leq 0.04\%$           | Not required             | Not required             |
| 28 day Permeability – ASTM C 1202   | $\leq 1500$ Coulomb      | Not required             | Not required             |

**Field Testing for Process Control**

<table>
<thead>
<tr>
<th></th>
<th>6 to 8 in. at point of placement</th>
<th>&gt;6 in. at point of placement</th>
<th>&gt;8 in. at point of placement</th>
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<tbody>
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<td>&gt;6 in. at point of placement</td>
<td>&gt;8 in. at point of placement</td>
</tr>
<tr>
<td>Air Content - ASTM C 231</td>
<td>Not required</td>
<td>5.5% to 7.5%</td>
<td>Not required</td>
</tr>
<tr>
<td>28 day Strength - ASTM C 39</td>
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<td>$f_c' = 4500$psi</td>
<td>$f_c' = 700$psi</td>
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<tr>
<td>28 day Permeability – ASTM C 1202</td>
<td>$\leq 1500$ Coulomb</td>
<td>Not required</td>
<td>Not required</td>
</tr>
</tbody>
</table>

† Maximum combined supplementary materials content of ternary or quaternary blends. Limitations on supplementary materials shall include quantities contained in blended cement. Fly ash content shall not exceed 25%. Ground granulated blast-furnace slag content shall not exceed 45%. Silica fume content shall not exceed 10%.

END OF SECTION 336350
SECTION 336351 – CONCRETE REQUIREMENTS-CONCRETE FORMWORK

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of concrete formwork for exterior underground steam and condensate lines.

1.1 DESIGN GUIDELINES

A. General

1. Exposed Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faces or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

2. Unexposed Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material.

3. Steel forms, if used, shall be flat and smooth, without dents, free of rust and shall be tight fitting for all exposed surfaces.

4. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

5. Form ties shall be adjustable length, such that when forms are removed, ties leave no metal within 1" of finished surface. Tie holes shall leave holes not less than 1/2" nor more than 1" in depth.

6. All formwork shall be designed for the loads, lateral pressures, and allowable stresses outlined in ACI 347, "Recommended Practice for Concrete Formwork" and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local building code.

7. Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a suitable commercially manufactured type.

8. Forms shall be constructed sufficiently tight to prevent loss of mortar from the concrete.

9. Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during the concrete placing operations. Forms shall be securely braced to prevent lateral deflections.

10. Forms shall be constructed so that they can be removed without hammering or prying against the concrete.

11. All footings and foundations shall be formed. Pouring concrete against soil on the sides of the excavation will not be permitted.
12. Formwork shall be constructed such that the finished concrete surfaces are free of any abrupt dimensional changes requiring extensive corrective work such as patching or grinding and that formed concrete will conform to dimensional tolerances as follows:
   a. Variation from plumb 1/4" in 10'; 3/4" in 40' or more
   b. Variation from level 1/4" in 10'; 3/4" in 40' or more
   c. Variation of concrete lines from theoretical position indicated on drawings 1/2" in 20'; 1" in 40' or more
      a. Variation in size and location of sleeves And openings Plus or minus 1/4"
      b. Variation in the thickness of walls and structural slabs Plus 1/2" to minus 1/4"

13. Above tolerances do not relieve installer from responsibility of adhering to closer tolerances where required to coordinate concrete work with work of various trades or to achieve special architectural details.

14. Surfaces of plywood or other wood forms shall be sealed to prevent absorption of moisture from the concrete either by a factory applied non-absorbent liner or by a field application of an approved non-staining form oil or sealer. Where finished concrete surfaces are to be painted the form coating material shall be compatible with the type of paint to be used.

15. Oiling or sealing of forms shall be done prior to placing of the reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with concrete against which fresh concrete will be placed.

16. All forms shall be thoroughly cleaned and re-oiled or sealed before re-use.

17. All embedded items, such as sleeves, inserts, anchors, etc., shall be accurately located and securely fastened prior to placing concrete.

18. Voids in sleeves, inserts, anchor slots, etc., shall be filled temporarily with readily removable material to prevent entry of concrete into the voids.

19. All embedded items shall be clean and free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete shall be avoided.

20. Formwork not supporting weight of concrete, such as on walls, and similar parts of the work, may be removed as soon as concrete is sufficiently hard to not be damaged by form removal operations, but not sooner than 24 hours.

21. Do not strip any formwork or remove any covering from concrete placed in freezing weather until so permitted by proper attainment of strength.

22. Time during which temperature falls below 40oF shall not be counted in computing time for removal of forms, unless ambient temperature is kept above 40oF by artificial heating.
23. Whenever the formwork is removed during the required curing period, the exposed concrete shall be cured by one of the methods specified.

END OF SECTION 336351
SECTION 336351 – GENERAL CONCRETE REQUIREMENTS – CONCRETE REINFORCEMENT

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of concrete steam tunnels.

1.1 DESIGN GUIDELINES

A. General

1. All concrete reinforcement bars shall be fabricated with ChromX 9100 (ASTM A 1035, 100 ksi yield grade, deformed steel bars, unfinished).

2. All reinforcing bars shall be deformed conforming to ASTM A305 "Specifications for Minimum Requirements for the Deformation of Deformed Steel Bars for Concrete Reinforcements".


4. Tie wire shall be plastic coated 16 gauge black annealed wire.

5. Provide spacers, chairs, bolsters, and other devices to properly space and support reinforcing bars and welded wire fabric. Use plastic tipped accessories at exposed surfaces.

6. Reinforcing bars supported from formwork shall rest on coated wire bar supports or on bar supports made of dielectric material or other acceptable materials. Wire bar supports shall be coated with dielectric material, compatible with concrete, for a minimum distance of 2 inches from the point of contact with the reinforcing bars. Proprietary combination bar clips and spreaders used in walls with reinforcing bars shall be made of corrosion-resistant material or coated with dielectric material.

B. Installation

1. All work shall comply with provisions contained in the following documents:


   c. "Building Code Requirements for Reinforced Concrete" (ACI 318).

2. Reinforcing steel shall be stored off the ground and protected from oil, or other deleterious materials.
3. Clean oil, mud, loose rust and scale from reinforcing steel before concrete is placed. Locate accurately in forms and hold firmly with approved supports and spacers.

4. Use metal accessories to keep reinforcing clear distance from finish face of concrete surface as required by applicable standards.

5. Cutting of bars shall be with mechanical saw only. Torch cutting will not be allowed.

6. Provide supervision during placing of concrete to watch reinforcing and reset any bars displaced by pouring operation.

7. For welded wire fabric lap adjoining pieces one full mesh and lace splices with 16 gauge wire. Offset end laps in adjacent widths to prevent continuous laps.

END OF SECTION 336352
SECTION 336354 - GENERAL CONCRETE REQUIREMENTS - WATERPROOFING

PART 1 - GENERAL

The scope of this document is to provide instruction for the installation of waterproofing of concrete steam chases, tunnels and manholes.

1.1 DESIGN GUIDELINES:

A. General

1. Outside surfaces of all subgrade floors, walls and lids of new utility chase and walk tunnels, and subgrade walls, roof and risers of new manholes shall be waterproofed.

2. New concrete lids installed on existing chase or tunnel shall be waterproofed.

3. Included in this document is an Alternate Waterproofing System that should be considered in cases where the manholes, tunnels or pipe chases are located in very wet locations, such as near or below the water table. Coordinate usage of this method with Project Manager and Engineer. It is not anticipated to have any of this Alternate Waterproofing system included in this project.

B. Materials

1. Concrete Repair Materials - As recommended by waterproofing manufacturer.

2. Waterstops

   a. Waterstops for use in manholes and at base of utility chase/tunnel walls, and expansion joints shall be 6", PVC, serrated with center bulb. Waterstop to be Style 703 as manufactured by Greenstreak, St. Louis MO or approved equal.

   b. Waterstops for locations where the chase/tunnel abuts structures shall be a Split Flange - 6", PVC serrated with center bulb for new to new installations. Waterstop to be Style 723 as manufactured by Greenstreak, St. Louis MO or approved equal. For new to existing installations waterstop shall be a Style 609 as manufactured by Greenstreak, St. Louis MO or approved equal.

   c. Waterstops for location were the new chase abuts an existing structure shall be a Style 609 as manufactured by Greenstreak, St. Louis MO or approved equal.

   d. Waterstops for construction joints shall be 6", PVC, serrated. Waterstop to be Style 782 as manufactured by Greenstreak, St. Louis MO or approved equal.

   e. Waterstops for the precast lid to wall connection shall be Butyl-Rubber sealant. Waterstop to be Conseal CS-102 or approved equal.

3. Pre-Applied sheet Waterproofing
a. Provide Preprufe 300R membrane by Grace Construction Products, PreCon as manufactured by W.R. Meadows, and Miraply-H as manufactured by Carlisle or approved equal. Pre-applied integrally bonded sheet waterproofing membrane: 1.2 mm nominal thickness composite sheet membrane comprising .8 mm of high density polyethylene film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Tape and other accessories specified or acceptable to manufacturer of pre-applied waterproofing membrane.

4. Self-Adhesive Waterproofing Membrane
   a. Self-adhesive waterproofing membrane for use to transition from pre-applied sheet waterproofing to applied rubberized asphalt waterproofing. Provide sheet applied, self-adhered waterproofing membrane Blueskin WP200 by
      1) Thickness: 1.5 mm (60 mils) min.
      2) Flexibility: Pass @ -40 degrees C to ASTM D1970
      3) Vapor permeance: 2.8 ng/Pa.s.m^2 (.05 perms) to ASTM E96,
      4) Tensile strength (membrane): 2.24 MPa to ASTM D412,
      5) Tensile strength (film): 34.5 MPa to ASTM D882,
      6) Elongation: 300% to ASTM D412,
      7) Puncture resistance: 222 N min. to ASTM E154.

5. Hot Applied Rubberized Asphalt Waterproofing
   a. Components and membrane materials must be obtained as a single source from the membrane manufacturer to ensure total system compatibility and integrity. Provide Henry Company 790-11 SBS, Carlisle CCW-500 modified hot applied rubberized asphalt or approved equal. Rubberized asphalt waterproofing shall have the following qualities:
      1) Solids Content: 100%;
      2) Low Temperature Flexibility and Adhesion: No cracking, delamination or loss of adhesion @ 13 degrees F in accordance with CGSB 37-GP-50-M89;
      3) Flow (1/8 inch film on 75% angle for 5 hours @ 140 degrees F): No flow in accordance with ASTM D1191;
      4) Cone Penetration: More than 10 @ 32 degrees F, less than 110 @ 77 degrees F, less than 200 @ 122 degrees F in accordance with ASTM D1191;
      5) Water Absorption: Gain of 0.09g in accordance with CGSB 37-GP-50-M89;
      6) Flash Point (Open Cup): 545 degrees F in accordance with ASTM D92;
7) Water Vapor Permeance (3mm Film): 0.01 perms in accordance with ASTM E96 Procedure A and 0.02 perms in accordance with ASTM E96 Procedure E.

8) Ratio of Toughness to Peak Load: 0.04 min. in accordance with CGSB 37-GP-50-M89.

9) Toughness: 9.2J in accordance with CGSB 37-GP-50-M89.

10) Crack Bridging Capability: No cracking, splitting or loss of adhesion in accordance with CGSB 37-GP-50-M89.

11) Heat Stability (5 hours @ 390 degrees F): Meets flow, penetration and low temperature flexibility in accordance with CGSB 37-GP-50-M89.

6. Hot Rubberized Asphalt Primer
   a. Solvent based, synthetic rubber adhesive for hot applied rubberized asphalt membranes. Henry HE93018 polymer modified adhesive or approved equal.

7. Self-adhered waterproofing primer
   a. Polymer emulsion based primer for self-adhesive membranes. Henry Aquatac primer or approved equal. Self-adhesive waterproofing primer shall have the following physical properties:
      1) Color: Aqua
      2) Solids by Volume: 53%
      3) Weight: 8.3 lbs/gal
      4) Application Temperature: 25 ° F to 104° F
      5) Maximum VOC: 100 g/L
      6) Service temperature -40 ° F to 150° F

8. Neoprene Flashing
   a. Neoprene flashing sheets is used with 790-11 hot rubberized asphalt membrane at expansion joints and exposed flashing details. Neoprene flashing shall be Henry HE850AA or approved equal and shall have the following physical properties:
      1) Brittleness Point: -40 ° F
      2) Color: Black
      3) Elongation (Initial) ASTM D412 – 300%
      4) Tear Resistance (ASTM D624 Die C) 125 lbs/in min
5) Tensile strength, membrane: (ASTM D412 Die C) 1800 psi min  
6) Thickness: 60 mils

9. Fabric Reinforcement  

10. Precast Chase Lid to Cast-in-Place Chase Wall Interface Waterproofing  
a. Waterproofing shall be Con-Seal CS-102 Butyl Rubber Sealant or MU Engineer Approved Equal.  
b. One continuous strip centered on top of chase wall shall be installed per manufacturer’s instructions.

11. Termination Sealant  
a. Joint sealant shall be Henry HE925 BES moisture cure sealant for construction joints.

12. Termination Bars  
a. Termination bars shall be continuous stainless steel, 1/8” x 1” in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 8” centers.

13. Drainage Pipe  
a. 6”, schedule 80, perforated PVC piping with filter sock.

14. Protection Sheet  
a. Provide Henry G100S/S Protection sheet or approved equal for top of steam chases, tunnels and manholes.

15. Drainage Board  
a. Provide Henry DB520 drainage board or approved equal. Drainage board shall have the following properties:  
   1) Thickness: 7/16” thick  
   2) Compressive strength: 15,000 lb/sq.ft.  
   4) Backing sheet: Polymeric backing film for contact with softer waterproofing membranes.

16. Cold Applied Waterproofing (used with MU permission, only in certain circumstances)
a. Cold applied waterproofing to be used with MU permission only in certain circumstances such as space constraints and time delays not allowing hot applied product on “green” concrete. Cold applied waterproofing shall be Henry CM100 or engineer approved equal and shall have the following physical properties:

1) Comforms to ASTM C 836
2) Solvent content: 0%
3) Non Flammable, Flash point > 450 ° F.
4) Elongation: >500%
5) V.O.C. < 40 grams / Liter
6) Can be applied to “green” concrete.

17. Flashing and Crack Treatment Membrane (for cold applied applications)

a. Flashing and crack treatment membrane shall be 990-25 Elastomeric flashing sheet as supplied by Henry, a butyl/EPDM type, elastomeric membrane having a thickness of 47 mils.

C. Installation

1. Delivery, Storage, and Handling

a. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

b. Protect primer, mastic and adhesive from moisture and potential sources of ignition.

c. Store protection board flat and off the ground. Provide cover on top and all sides.

d. Sequence deliveries to avoid delays and minimize on-site storage.

2. Typical waterproofing installation includes concrete repairs, joint caulking, waterstops, preapplied sheet waterproofing, hot applied waterproofing and protection board. Refer to manufacturer's literature for instructions on installation.

3. Primer - Apply primer as recommended by manufacturer and allow to dry prior to the application of the primary waterproofing membrane or membrane flashings.

4. Joint and Crack Treatment

a. Joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging.
b. Joint Preparation

1) Clean joint surfaces immediately before installation of sealants. Remove dirt, insecure coatings, moisture, oil, form release agents and other substances which could interfere with seal of sealant.

c. Joint Size

1) In general, depth shall not exceed one-half of the width or be less than 1/4".

2) For joints in concrete depth can be equal to the width in joints up to 1/2" wide. Joints 1/2" to 1" wide shall have a depth of 1/2".

3) When joint depth exceeds the above ratios, fill with back-up material to provide the proper depth when measured from the joint face.

d. Application

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

2) Install back-up material or joint filler to provide sealant depth required for a proper joint. Back-up material shall be of suitable size and shape so that it will fit into joint when compressed 25% to 50%. Sealants shall not be applied without back-up material and, if necessary, bond breaker strip. When installing back-up rod stock, roll the material into the joint to avoid stretching twisting or braiding.

3) Do not seal during damp or inclement weather, or when the ambient or surface temperature is below 40oF or higher than temperatures as recommended by sealant manufacturer.

4) Do not allow sealants to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

e. Fill cracks with joint sealant per waterproofing material construction standards.

f. Seal cracks and joints 1/16 inch to 1/8 inch in width with a 12 inch wide, 1/8 inch thick coat of hot rubberized asphalt membrane and a 6 inch wide strip of fabric reinforcement, centered over joint.

g. Seal cracks and joints 1/8 inch to ½” inch in width with a 12 inch wide, 1/8 inch thick coat of hot rubberized asphalt membrane and a 6 inch wide strip of neoprene flashing centered over joint.
5. Application of Hot Rubberized Asphalt Membrane
   a. Ensure concrete is ready to receive hot applied rubberized asphalt membrane.
   b. Apply membrane smooth, free from air pockets, wrinkles or tears and to manufacturer’s instructions. Ensure full bond of membrane to substrate.
   c. Apply first layer of hot rubberized asphalt membrane evenly to a minimum thickness of 90 mils to form a continuous monolithic coating over horizontal and vertical surfaces including previously reinforced areas.
   d. Apply fabric reinforcing sheet and firmly press into first layer of hot membrane. Overlap fabric approximately ¼ inch ensuring that a layer of membrane is present between overlaps. Apply second layer of membrane over the fabric to a minimum thickness of 1/8 inches providing a total thickness of 215 mils.

6. Installation of Protection Course/Separation Sheet
   a. Protection shall be rolled onto hot applied rubberized asphalt membrane while still warm and tacky.
   b. Lap protection course 2 inches on side laps and 6 inches on end laps.
   c. Starting at the low points or drains lay the protection course membrane in full continuous sheets in a shingle pattern. Stager all end laps.

7. Cast-in-place Concrete Substrates
   a. Do not proceed with installation until concrete has properly cured and dried. If recommended by the manufacturer, special primers may be used to allow priming and installation of hot applied waterproofing sooner than 7 days. Priming may begin as soon as the concrete will maintain structural integrity.
   b. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   c. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
   d. Remove scaling to sound, unaffected concrete and repair exposed area.
   e. Grind irregular construction joint to suitable flush surface.
   f. Treat joints and install flashing as recommended by waterproofing manufacturer.

8. Waterstops
   a. Waterstops shall be installed in strict accordance with manufacturer's recommendations with particular care being given to properly setting in adhesive and maintaining the required 2" minimum concrete coverage.

9. Cleaning and Protection
a. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

b. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

c. Butt joint between precast lids shall be sealed immediately after placing lids in order to minimize water infiltration prior to applying waterproofing. Seal with horizontal joint sealant as specified.

10. Quality Assurance

a. Installer shall be firm which has at least 3 years of experience in work of the type required by these Construction Standards.

b. For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer to the extent possible.

11. Project Conditions

a. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

b. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

12. Execution

a. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled area, loose aggregate and sharp protrusions. Remove contaminates such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to membrane manufacturer.

b. All concrete waterproofing shall be fully placed and inspected by the owner prior to proceeding to the next step of installation. Owner shall receive 24 notice of inspection being required. These inspections for approval shall include;

   1) Substrate conditions and preparations

   2) Flashing installation

   3) Membrane installation

   4) Protection and drainage installation

13. Alternate Waterproofing System
In extremely wet locations drain piping shall be added to the waterproofing design. Refer to the construction standard drawings. The piping shall be routed to the nearest storm sewer utilizing a separate sump pump manhole when required.

14. Warranty: Provide written five (5) year material warranty for sheet membrane waterproofing issued by the membrane manufacturer upon completion of the work.

1.2 REFERENCES

A. Refer to detail “Steam Chase Waterproofing”, on mechanical detail sheet(s).

END OF SECTION 336354
SECTION 333700 – CONCRETE REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Special Conditions, apply to the Work specified in this Section.

1.2 SCOPE
   A. The Contractor shall repair damaged areas of existing concrete chases and manholes as shown on the drawings and specified herein.
   B. For bid purposes, assume reinforcement bars are spaced on 12” centers, vertically and horizontally, unless noted otherwise on the drawings.

1.3 SUBMITTALS
   A. Submit manufacturer’s product data sheets for all materials to be used.
   B. Submit manufacturer’s instructions for the repair and corrosion control systems.
   C. Submit photographs of repair areas as follows:
      1. After damage concrete has been removed but prior to repair work.
      2. After exposed concrete and reinforcement have been prepared.
      3. After galvanic anodes have been installed.
      4. After repairs are completed.

1.4 QUALITY ASSURANCE
   A. All work shall be done in strict accordance with the manufacturer’s recommendations and applicable American Concrete Institute bulletins:
      1. ACI RAP-6, Vertical and Overhead Spall Repair by Hand Application
   B. Prior to proceeding with repairs, Contractor shall have a preconstruction meeting on site with certified field representative(s) from the manufacturer(s) of the repair materials. The manufacturer’s representative(s) shall provide training to contractor’s personnel executing and supervising the repair work and to the Owner’s Representative. The training shall address the parameters, means, methods, and materials necessary to achieve proper repairs.
C. Following the preconstruction meeting, the manufacturer’s field representative(s) shall observe and approve the first repair completed by the Contractor.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Specifications are based on Sika products. Equivalent products by approved manufacturers may be used.

2.2 COATINGS
   A. Reinforcement anti-corrosion coating shall be a three-component, solvent-free, moisture-tolerant, epoxy-modified, cementitious material, Armatec 110 EpoCem, as manufactured by Sika Corporation, or approved equal.
   B. Concrete primer shall be a three-component, solvent-free, moisture-tolerant, epoxy-modified, cementitious material, Armatec 110 EpoCem, as manufactured by Sika Corporation, or approved equal.

2.3 REPAIR MORTAR
   A. Repair mortar shall be polymer-modified, cementitious repair mortar with integral penetrating corrosion inhibitor, Sika “SikaTop 123 Plus”, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Examine concrete surfaces in the general area of repair by sounding to detect any deficiencies not shown on the Drawings.
   B. The Contractor shall clearly mark the areas to be repaired for the Owner’s review and approval prior to commencing work.
   C. Comply with paragraph 1.4, Quality Assurance.

3.2 SURFACE PREPARATION
   A. The surface shall be mechanically prepared. Areas to be repaired shall be clean, sound and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means.
   B. Chip concrete substrate to obtain a surface profile of ±1/16” in depth with a new fractured aggregate surface.
C. Area to be repaired shall be no less than 1/8” deep. Saw cut edges at an angle 15 degrees from perpendicular from the face of the surface to 1/2” minimum depth to key in the patch and avoid feather edges. Do not cut steel reinforcement.

D. Where exposed reinforcing steel is encountered the following procedures shall be used.
   1. Chip out behind the reinforcing steel to a depth of about ¾”.
   2. Where corrosion of the reinforcing steel exists, continue concrete removal along the reinforcing steel until corrosion damage is minimal and will not interfere with the bond between the steel and repair materials.
   3. If the reinforcing steel cross sectional area has been reduced by greater than 25%, advise the Owner’s Representative prior to proceeding further. Repair reinforcement as indicated on the Drawings.
   4. Sandblast the reinforcing steel to remove all contaminants and rust.

E. High pressure wash the repair area with potable water to remove chlorides.

3.3 ANTI-CORROSION APPLICATION
   A. Apply anti-corrosion material with stiff bristle brush or spray, 20 mils thick covering all exposed reinforcing steel. Cure to tack-fee 2-3 hours.
   B. Apply a second coat of 20 mils. Allow to dry again before applying repair mortar.

3.4 CONCRETE PRIMER
   A. Apply concrete epoxy primer to profiled concrete surface prior to installing repair mortar.
   B. Apply in full accordance with manufacturer’s instructions.
   C. Concrete substrate shall be saturated surface dry (SSD) with no standing water during application of primer and repair mortar.

3.5 REPAIR MORTAR
   A. Prepare and apply mortar in full accordance with manufacturer’s instructions.
   B. While epoxy adhesive coat is still tacky apply repair mortar.
   C. Minimum thickness of mortar shall be 1/8”. Do not feather edges.
   D. For applications greater than 1-1/2” in depth, apply repair mortar in lifts. Score the top surface of each lift to produce a roughened surface for the next lift. Allow preceding lift to reach final set.
E. Surface shall be neatly trowel finished and cured in accordance with manufacturer’s instructions.

END OF SECTION 033700