

PROJECT MANUAL FOR:

**UNIVERSITY OF MISSOURI –
SCHWEITZER HALL –
ROOF REPLACEMENT**

PROJECT NO.: CP231262

**AT:
UNIVERSITY OF MISSOURI - COLUMBIA
COLUMBIA, MISSOURI**

**FOR:
THE CURATORS OF THE
UNIVERSITY OF MISSOURI**

PREPARED BY:

***RMT ROOFING &
WATERPROOFING
CONSULTANTS,
INC.***



**CAMPUS FACILITIES
UNIVERSITY OF MISSOURI**

January 17, 2024

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AT
UNIVERSITY OF MISSOURI - COLUMBIA
COLUMBIA, MISSOURI

FOR:

THE CURATORS OF THE UNIVERSITY OF MISSOURI

PREPARED BY:

RMT ROOFING & WATERPROOFING CONSULTANTS, INC.
410 SOVEREIGN COURT SUITE 18
BALLWIN, MO 63011
RYAN O'CONNELL
636-391-2185

DATE: JANUARY 17, 2024

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PROJECT NUMBER: CP231262

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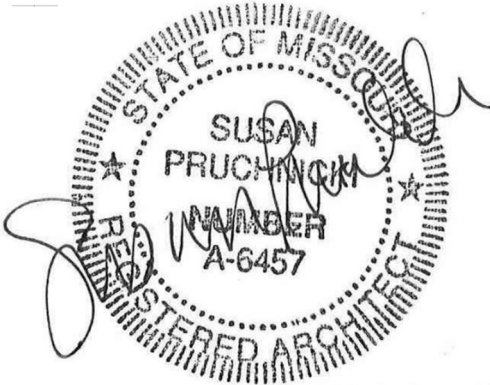
END OF SECTION

ARCHITECTURAL

The Architects seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the Architect takes responsibility for the attached architectural specifications. The Architect 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.

The following drawings and specifications have been prepared by me or under my direct supervision:

DRAWINGS:	SPECIFICATIONS:
A101 Demolition Schedule	02 4119 Selective Demolition
A102 Renovation Schedule	04 0650 Mortar Masonry Grout
A103 Detail Sheet 1	04 5000 Masonry Restoration
A104 Detail Sheet 2	06 1000 Rough Carpentry
A105 Detail Sheet 3	07 3150 Slate Shingles
A106 Vent Detail Sheet	07 5401 Thermoplastic Membrane
	07 5950 Preparation for ReRoofing
	07 6200 Sheet Metal Flashing
	07 7200 Roof Accessories
	07 7900 Joint Sealants



CERTIFICATION PAGE

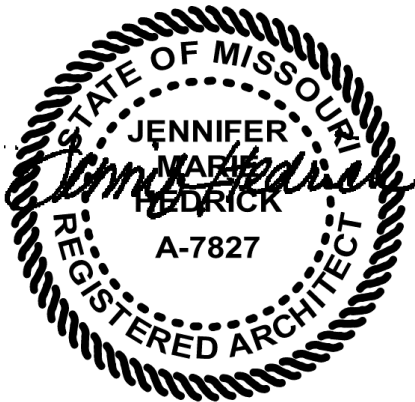
Project Title **Schweitzer Hall – Roof Remediation & Replacement**
MU Project # CP231262

Design Professional of Record: Architect

The Architects seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the Architect takes responsibility for the attached architectural specifications. The Architect 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.

The following drawings and specifications have been prepared by me or under my direct supervision:

Drawings:	Specifications:
A200 - REFERENCE PLAN / INFECTION CONTROL & INDOOR CONSTRUCTION LOGISTICS	03 3000 CAST-IN-PLACE CONCRETE
A201 - GROUND FLOOR DEMOLITION RCP & NEW WORK	09 2216 NON-STRUCTURAL METAL FRAMING
A202 - FIRST FLOOR DEMOLITION AND NEW WORK RCP	09 2900 GYPSUM BOARD
A203 - SECOND FLOOR DEMOLITION AND NEW WORK RCP	09 5113 ACOUSTICAL PANEL CEILINGS
A204 - ATTIC NEW WORK PLAN	

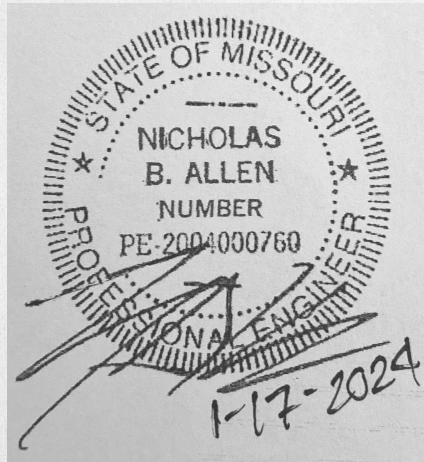


Design Professional Name: Jennifer Marie Hedrick
State of Missouri License Number: A-7827

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.

(seal) Signature: 



STRUCTURAL CERTIFICATION

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/drawings. 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.

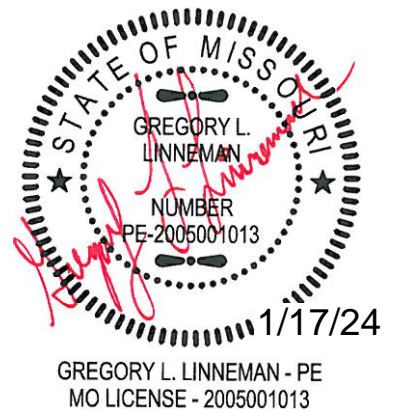
DRAWINGS:

S100 ATTIC FLOOR FRAMING PLAN AND DETAILS

S200 ROOF FRAMING PLAN AND DETAILS



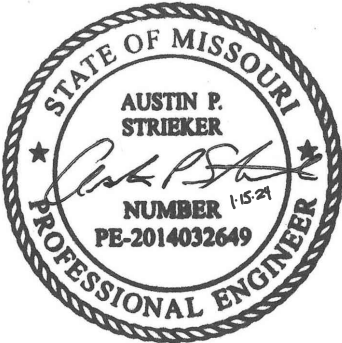
(seal) Signature: _____



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.

(seal) Signature: 



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PLANNING DESIGN & CONSTRUCTION

General Services Bldg.
Columbia, Missouri 65211
Telephone: (573) 882-6800

ADVERTISEMENT FOR BIDS

Sealed bids for:

SCHWEITZER HALL –
ROOF REPLACEMENT
UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI

PROJECT NUMBER: CP231262

CONSTRUCTION ESTIMATE \$3,912,210 - \$4,346,900

will be received by the Curators of the University of Missouri, Owner, at Planning, Design & Construction, Room L100 (Front Reception Desk), General Services Building, University of Missouri, Columbia, Missouri 65211, until 1:30 p.m., C.T., February 15, 2024 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 Jessie Crocker at (573) 882-5886 or crockerjl@missouri.edu.

A prebid meeting will be held at 9:00 a.m., C.T., January 31, 2024 in the General Services Bldg., Rm194B, University of Missouri, Columbia, Missouri, followed by a site walk-through. All interested bidders are invited to attend this meeting.

A Diversity Participation goal of 10% MBE, 10% Combined WBE, DBE, Veteran Owned Business 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 17, 2024

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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 "Schweitzer Hall – Roof Replacement", project number CP231262, dated January 17, 2024 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

Base Bid:

- a. The Bidder agrees to furnish all labor, materials, tools, and equipment required to complete all as indicated on the Drawings and described in these Specifications for sum of: _____ DOLLARS (\$_____).
- b. Additive Alternate Bids:

Above Base Bid may be changed in accordance with following Alternate Bids as Owner may elect. Alternates are as described in Section 1.H of Project Manual. Alternates are written in a priority order, but Owner is not required to accept or reject in order listed. This is a one (1) contract project; therefore, Alternates shall be studied by each Bidder to determine the effect on Bids of Contractor and each Subcontractor and/or Material supplier.

- (1) Additive Alternate No. 1:

Fall Protection Roof Davits

All for sum of:

_____ DOLLARS (\$_____).

4. UNIT PRICING

- (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.

a. Wood Nailer Replacement and all materials (i.e. fasteners, clips, etc.)
Cost per 2"x4"x10" \$ _____

b. EPDM Membrane Extra Rolls
Cost per Roll \$ _____

c. Wood framing repair unit prices. Remove and replace damaged wood roof sheathing and all materials (i.e.. fasteners, etc.) per sheet S200

Base Bid Quantity = 200 sq.ft. Cost per SF \$ _____

d. Wood framing repair unit prices. Remove and replace damaged wood roof 2x framing and all materials (i.e. fasteners, clips, etc.) per sheet S200

Base Bid Quantity = 500 bd.ft. Cost per BF \$ _____

5. 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 forty-four (144) 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.

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

a. The Contractor shall have as a goal, subcontracting with Minority Business Enterprise (MBE) of ten (10%), with Women Business Enterprise (WBE) of ten (10%), Disadvantage Business Enterprise (DBE) ten (10%), and/or Veteran Owned Business of ten (10%) and with 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 PERCENTAGE PARTICIPATION:

_____ percent (_____%)

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.
- e. Bidder agrees that bid shall not be withdrawn for a period of ninety (90) days after scheduled closing time for receipt of bids
- f. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.
- g. Accompanying the bid is a bid bond, or a certified check, 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.

- h. 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.
- i. 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.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one: Individual Partnership Corporation Joint Venture	
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).

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	------------------------------	--------------	-----------	-------------------------	-------------------

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.

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	------------------------------	--------------	-----------	-------------------------	-------------------

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).

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	------------------------------	--------------	-----------	-------------------------	-------------------

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.

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	------------------------------	--------------	-----------	-------------------------	-------------------

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 _____

- (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: _____

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.

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 _____

AFFIDAVIT FOR AFFIRMATIVE ACTION

State of Missouri)
)
County of) ss.

_____ 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_____.

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/slcdc/

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
W: www.flystl.com/business/business-diversity-development-1/directories

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.mwdbe.com/?TN=kcmohrd

Mid-States Minority Supplier Development Council
505 N. 7th Street, Ste. 1820
St. Louis, MO 63101
P: 314.278.5616
W: midstatesdc.org

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.mwdbe.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: oa.mo.gov/sites/default/files/sdvelisting.pdf
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.scanews.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:

	Scope of Work	Bid/Contract Amount	Final Dollar Amount
Base Bid			
Alternate #1			
Alternate #2			
Alternate #3			
Alternate #4			
Alternate #5			
Alternate #6			

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: _____

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University of Missouri

INFORMATION FOR BIDDERS

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1. Contract Documents

1.1 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 anything 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 informalities 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 workdays) 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 bid 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 meet the requirements of this Article 11, 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.

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.

A 3-point Service-Disabled Veteran Enterprises (SDVE) bonus preference shall apply to this contract. The 3 bonus points can be obtained by a certified, Missouri based SDVE performing a commercially useful function, (as defined in Article 1 of the General Conditions of the Contract for Construction) either by submitting a bid directly to the Owner, or through the utilization of certified SDVE subcontractors and/or suppliers, whose participation provides at least 3% of the total bid amount. A firm does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of SDVE participation. In determining whether a firm is such an extra participant, the Owner will examine similar transactions, particularly those in which SDVEs do not participate. The 3-point bonus preference shall be calculated and applied by reducing the bid amount of the eligible bidder by three (3) percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible bidder's resulting total bid valuation is less than the apparent low responsive bidder's bid, the eligible bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only and will have no impact on the actual amount(s) of the eligible bidder's bid or the amount(s) of any contract awarded. The submitted bid form must include a minimum of 3% SDVE participation to obtain the three (3) point bonus. For every SDVE firm utilized, a completed AFFIDAVIT OF SUPPLIER DIVERSITY PARTICIPATION form shall be submitted to the Owner within 24 hours of the receipt of bids. Failure to do so may be grounds for rejection of the SDVE bonus preference.

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.

15.5 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. Bidders 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 workday) 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.

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University of Missouri

General Conditions

of the

Contract

for

Construction

December 2021 Edition

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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 Owner's Authorized Agent

When the term "Owner's Authorized Agent" is used herein, it shall refer to an employee or agency acting on the behalf of the Owner's Representative to perform duties related to code inspections, testing, operational systems check, certification or accreditation inspections, or other specialized work.

1.1.6 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.

1.1.7 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.

1.1.8 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 Marianas.

.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 Served-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 Served-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", "compliant", "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 hereto 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 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(s) 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.

1.1.21 Force Majeure

An event or circumstance that could not have been reasonably anticipated and is out of the control of both the Owner and the Contractor.

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 departure 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 remedying 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 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 surety. In such case, Owner shall be entitled to deduct from payments then or thereafter due the Contractor the cost of completing the Punch List items, including compensation for the Architect's additional services. If payments then or

thereafter due Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to Owner.

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 breach 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, Regulations, Permits, Codes, and Inspections

3.2.1 The Contractor shall, without additional expense to the Owner, comply with all applicable laws, ordinances, rules, permit requirements, codes, 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 the 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 benchmark 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.
- .2** Contractor shall submit its preliminary outage/tie-in schedule with its baseline schedule.
- .3** The Contractor shall request an outage/tie-in meeting at least two weeks before the outage/tie-in is required.
- .4** The Owner's Representative will schedule an outage/tie-in meeting at least one week prior to the outage/tie-in.

3.4.8 The Contractor shall coordinate all Work so there shall be no prolonged interruption of existing utilities, systems, and equipment of Owner. Any existing plumbing, heating, ventilating, air conditioning, or electrical disconnection necessary, which affect portions of this construction or building or any other building, must be scheduled with the Owner's Representative to avoid any

disruption of operation within the building under construction or other buildings or utilities. In no case shall utilities be left disconnected at the end of a workday or over a weekend. Any interruption of utilities, either intentionally or accidentally, shall not relieve the Contractor from repairing and restoring the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

3.4.9 The Contractor shall be responsible for repair of damage to property on or off the project occurring during construction of project, and all such repairs shall be made to meet code requirements or to the satisfaction of the Owner's Representative if code is not applicable.

3.4.10 The Contractor shall be responsible for all shoring required to protect its work or adjacent property and shall pay for any damage caused by failure to shore or by improper shoring or by failure to give proper notice. Shoring shall be removed only after completion of permanent supports.

3.4.11 The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for students, faculty, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

3.4.12 During the performance of the Work, 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 or inspection 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 compliant and 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 existing 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 and code 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 include, 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 any 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 Delegated Design

3.11.1 If the Contract Documents specify the Contractor is responsible for the design of any work as part of the project, then the Contractor shall procure all design services and certifications necessary to complete the Work as specified, from a design professional licensed in the State of Missouri. The signature and seal of that design professional shall appear on all drawings, calculations, specifications, certifications, shop drawings, and other submittals related to the Work. The design professional shall maintain insurance as required per Article 11.

3.12 Materials, Labor, and Workmanship

3.12.1 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.

3.12.2 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.

3.12.3 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.

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

3.12.5 Materials and workmanship shall be subject to inspection, examination, and testing 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.

3.12.6 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.

3.12.7 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.

3.12.8 Substitutions

3.12.8.1 A substitution is a Contractor proposal of an alternate product or method in lieu of what has been specified or shown in the Contract Documents, which is not an "or equal" as set forth in Section 3.12.1.

3.12.8.2 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 Document requirements and is code compliant, 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.

3.12.8.3 Substitutions may be rejected without explanation at the 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.

3.12.8.4 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 substitution.

3.13 Approved Equal

3.13.1 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 and is code compliant.

3.13.2 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.

3.13.3 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, device, 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.

3.14 Shop Drawings, Product Data, Samples, and Coordination Drawings/BIM Models

3.14.1 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.

3.14.2 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.

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

3.14.4 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.

3.14.5 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.

3.14.6 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 unrealistic, and shall specify a date on which the submittal will be provided, 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.

3.14.7 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.

3.14.8 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.

3.14.9 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.

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

3.14.11 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.

3.14.12 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.

3.14.13 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.

3.14.14 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.

3.15 Record Drawings

3.15.1 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.

3.16 Operating Instructions and Service Manuals

3.16.1 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.

3.16.2 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.

3.17 Taxes

3.17.1 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.

3.17.2 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.

3.17.3 Any excess resalable tangible personal property or materials which were purchased for the project under this Project Tax Exemption Certificate but which were not incorporated into or consumed in the Work shall either be returned to the supplier for credit or the appropriate sales or use tax on such excess property or materials shall be reported on a return and paid by such purchasing party not later than the due date of the purchasing party's Missouri sales or use tax return following the month in which it was determined that the materials were not used in the Work.

3.17.4 If it is determined that sales tax is owed by the Contractor on property and materials due to the failure of the Owner to revise the certificate expiration date to cover the applicable date of purchase, Owner shall be liable for the tax owed.

3.17.5 The Owner shall not be responsible for any tax liability due to Contractor's neglect to make timely orders, payments, etc. or Contractor's misuse of the Project Tax Exemption Certificate. Contractor represents that the Project Tax Exemption Certificate shall be used in accordance with RSMo § 144.062 and the terms of the Project Tax Exemption

Certificate. Contractor shall indemnify the Owner for any loss or expense, including but not limited to, reasonable attorneys' fees, arising out of Contractor's use of the Project Tax Exemption Certificate.

3.18 Contractor's Construction Schedules

3.18.1 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.

3.18.2 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.

3.18.3 As time is of the essence to this contract, the University expects that the Contractor will take all necessary steps to ensure 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 schedule 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.

3.18.4 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 right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, facilities, (3) expediting delivery of materials, and (4) other similar measures (hereinafter referred to collectively as Extraordinary Measures). Such Extraordinary Measures shall continue until the progress of 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, the Owner's Representative, and the Owner's Authorized Agent 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 rescission. 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.

.1 Time extensions will be considered for excusable delays only. That is, delays that are beyond the control and/or contractual responsibility of the Contractor.

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

.1 The Contractor must have fulfilled its contract obligations with respect to temporary facilities and protection of its work, and worker protection for hot and cold weather per OSHA guidelines.

.2 If the contract obligations have been satisfied, the Owner will review requests for non-compensable time extensions for critical path activities as follows:

.2.1 If the Contractor cannot work on a critical path activity due to adverse weather, after implementing all reasonable temporary weather protection, the Contractor will so notify the Owner's Representative. Each week, the Contractor will notify the Owner's Representative of the number of adverse weather days that it believes it has experienced in the previous week. As provided in the contract, until such time as the weather days acknowledged by the Owner's Representative exceed the number of days of adverse weather contemplated in the Special Conditions, no request for extension of the contract completion time will be considered.

.2.2 If the Contractor has accumulated in excess of the number of adverse weather days contemplated in the Special Conditions due to the stoppage of work on critical path activities due to adverse weather, the Owner will consider a time extension request from the Contractor that is submitted in accordance with the contract requirements. The Owner will provide a change order extending the time for contract completion or direct an acceleration of the work in accordance with the contract terms and conditions to recover the time lost due to adverse weather in excess of the number of adverse weather working days contemplated in the Special Conditions.

4.7.3 A Force Majeure event or circumstance shall not be the basis of a claim by the Contractor seeking an adjustment in the Contract amount for costs or expenses of any type. With the exception of weather delays which are administered under this Article 4, and notwithstanding other requirements of the Contract, all Force Majeure events resulting in a delay

to the critical path of the project shall be administered as provided in Article 8.

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, 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, non-compliant, 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.

- .3** 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 that 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.

7.1.5 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.

7.1.6 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, expeditors, 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

 - 7.5% Credit to the Owner from 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 proceed with the emergency work as directed by the Owner under the applicable provisions of the contract. In so doing, Contractor agrees that all provisions of the contract remain in full force and effect and the schedule for the Work is not impacted in any way unless explicitly agreed to in writing by the Owner.

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, Force Majeure including but not limited to war, armed conflict, riot, civil commotion or disorder, act of terrorism or sabotage; epidemic, pandemic, outbreaks of infectious disease or any other public health crisis, including quarantine or other employee restrictions, compliance with any law or governmental order, rule, regulation or direction, curfew restriction, act of God or natural disaster such as earthquake, volcanic activity, landslide, tidal wave, tsunami, flood, damage or destruction by lightning, drought; explosion, fire, destruction of machines, equipment, prolonged break-down of transport, telecommunication or electric current; general labor disturbance such as but not limited to boycott, strike and lock-out, occupation of factories and premises, 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) justifying the delay 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 of 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. If a Force Majeure is approved by the Owner as the basis for a delay claim, an adjustment in the contract time to the extent the Force Majeure impacts the schedule is the only remedy. No increase in the contract sum for any reason shall be allowed due to a Force Majeure.

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 claims due to or caused by any events beyond the control of both the Owner and Contractor defined herein as Force Majeure. 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 provide written notice to the Owner within seven (7) calendar days of the event giving rise to such claim. 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, but in no case shall Force Majeure be the basis of an increase in the Contract sum. 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 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 the Owner a current certificate, in which event, no additional certificate will be required during the period of time for which such current certificate remains in effect.

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.

- .1 Reproducible progress and payment schedule
- .2 Contractor's Schedule of Values
- .3 List of material suppliers
- .4 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.
- .5 Itemized breakdown of anticipated equipment rates (breakout operator rate). 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:

- .1 Bank Transit Number for the Contractor's bank into which the electronic deposit will be made.
- .2 Bank Account Number for the Contractor's account into which the electronic deposit will be made.
- .3 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:

- .1 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.
- .2 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 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 to 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.
- .7 Upon favorable inspection by the Owner's Representative, the Contractor shall, at the Owner's option, submit a Bill of Sale and Bailment Agreement on forms provided by the Owner's

Representative, 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.
- .11 The Contractor shall furnish and maintain insurance covering the replacement cost of the material stored offsite against all losses and shall furnish proof of coverage with the application for payment for material stored offsite.
- .12 The Contractor is responsible for all costs related to storage and handling of material stored offsite unless otherwise directed by the Owner's Representative.

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 be necessary in the Owner's Representative opinion to protect the Owner from loss because of:

- .1 defective or non-compliant 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 1.1.14 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, retainage, 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
- .3** 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, standards, codes, 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 its employees and its 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.

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 officers, employees, and agents of 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/Other Requirements

11.5.1 Any Consultant/Contractor providing professional design services as part of the contract shall be required to provide and maintain, from the date of this Contract and for a period of ten (10) years after the date of Final Completion, Professional Liability insurance to cover any claims, including but not limited to errors, omissions, and negligence, which may arise from the Design and related Services performed by the Consultant. The minimum limits for such Policy shall be \$1,000,000.00 per occurrence/\$1,000,000.00 aggregate. The insurance afforded by the policy shall meet the requirements of this Section 11.2 and Section 11.5 relating to CGL Policies, and without limiting the foregoing, shall be extended to cover the liability of "The officers, employees, and agents of The Curators of the University of Missouri", who shall be named as additional insureds therein, and this liability is assumed in writing by the Contractor's Consultant under the written Subcontract described herein. 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

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, or non-compliant 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, codes, 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, the Owner's Authorized Agent, or entity acceptable to the Owner, and the Contractor shall bear related costs of tests, inspections, and approvals as required in the Contract Documents. The Contractor shall give the Architect, Owner's Representative, and the Owner's Authorized Agent timely notice of when and where tests and inspections are to be made so the

Architect, the Owner's Representative and/or the Owner's Authorized Agent may observe procedures or perform the necessary tests or inspections.

13.3.2 If the Architect, Owner's Representative, or the Owner's Authorized Agent 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, the Owner's Representative or the Owner's Authorized Agent, of when and where tests and inspections are to be made so the Architect, Owner's Representative and/or the Owner's Authorized Agent, may choose that the tests or inspections can be performed or observed. 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 and Owner's Authorized Agent'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 records. The Owner may, at any time, request copies of, and/or inspect all of the Contractor's payroll records for the Work to verify compliance. The Contractor shall furnish the Owner copies of payroll records within 10 days of the Owner's written request. The Contractor shall provide copies of workers I-9 forms within 24 hours of written notice. (If applicable, and required by Owner, the Contractor will demonstrate that the Contractor is enrolled and participating in a federal work authorization program with respect to the employees working in connection with this project.) Such payroll records shall be maintained in accordance with Article 13.7.1 and shall be available for inspection for two (2) years after final completion of the Work. The contractor further agrees, in the event the records are not presented as requested, he will abide by any decision made by the Owner regarding underpayment of wages to workers and amounts owed them as well as liquidated damages for underpayment of wages. Falsification of the certified payroll records may

result in the debarment of the contractor or subcontractor from future work with the University.

13.6.3 The acquisition of products or services is subject to the supplier's conformance to the rules and regulations of the President's Committee on Equal Employment Opportunity (41 CFR, Ch. 60).

13.6.4 The Contractor shall comply with the Copeland Regulations of the Secretary of Labor (29 CFR, Part 3), which are incorporated herein by reference. In addition, the Weekly Statement of Compliance required by these Regulations shall also contain a statement that the applicable fringe benefits paid are equal to or greater than those set forth in the minimum wage decision.

13.6.5 Contractor acknowledges that violation of the requirements of Article 13.6 result in additional costs to Owner, including, but not limited to, cost of construction delays, of additional work for Owner's staff and legal expense. The cost of Contractor's violation of the provisions of Article 13.6 would be and is difficult to determine and establish. In the event that Contractor fails to comply with the provisions of this Article 13.6, Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of Fifty Dollars (\$50.00) per day per individual who is paid less than the applicable prevailing wage, to approximate the investigative cost resulting to the Owner for such violations. To approximate the delay costs, Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of One Hundred Dollars (\$100.00) per day for each day the Contract cannot be closed out and final payment made because of Contractor's failure to comply with the provisions of this Article 13.6. Such liquidated damages shall be collected regardless of whether the Work has been completed. The liquidated damages and other amounts set forth in this Article 13.6 shall be in addition to all other liquidated damages the Owner may be entitled as set forth in the Contract Documents.

13.6.6 The Owner may deduct liquidated damages described Article 13 and the amounts set forth in Article 13 from any unpaid amounts then or thereafter due the Contractor under the Contract. Any liquidated damages not so deducted from any unpaid amounts due the Contractor 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 journeyman rate of pay. "Entry Level Workers; must be registered apprentices. The apprenticeship ratio will be one to one with a journeyman of the same classification. Any worker not registered as an apprentice per this section will be paid as a journeyman.

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.

- .1** ICC International Building Code and reference standards
- .2** ICC International Plumbing Code
- .3** ICC International Mechanical Code
- .4** ICC International Fire Code
- .5** ICC International Fuel Gas Code
- .6** NFPA 70 National Electric Code (NEC)
- .7** Americans with Disabilities Act – Standards for Accessible Design.
- .8** American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks as published by the American Society of Mechanical Engineers (ASME), American National Standards Institute (ANSI) A17.1
- .9** NFPA 101 Life Safety Code (as noted above)
- .10** American Concrete Institute (ACI)
- .11** American National Standards Institute (ANSI)
- .12** American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .13** American Refrigeration Institute (ARI)
- .14** American Society for Testing and Materials (ASTM)
- .15** Missouri Standard Specification for Highway Construction, Missouri State Highway Commission

- .16 National Electrical Manufacturers Association (NEMA)
- .17 Underwriter's Laboratories, Inc. (UL), Federal Specifications
- .18 Williams Steiger Occupational Safety and Health Act of 1970 (OSHA)

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 Certification

13.10.1 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).

13.10.2 If this contract is for \$100,000 or more, and if the Contractor is a company with ten (10) or more employees, then Contractor certifies that it, and any company affiliated with it, does not boycott Israel, and will not boycott Israel during the term of this Contract. In this paragraph, the terms "company" and "boycott Israel" shall have the meanings described in Section 34.600 of the Missouri Revised Statutes.

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, codes, regulations or orders of an authority having jurisdiction;
- .5 disregards the authority of the Owner's Representative, Architect, or Owner's Authorized Agent;
- .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.

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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 17, 2024**, entitled "**Schweitzer Hall – Roof Replacement**", project number **CP231262**.

b. Architect / Engineer
Planning, Design, and Construction
Campus Facilities
University of Missouri
Columbia, MO 65211
(573) 882-6800

b. RMT Roofing & Waterproofing Consultants, Inc.
Ryan O'Connell
(314) 391-2185

c. SOA Architecture
Nick Bormeyer
(573) 443-3418

e. Crockett Engineering Consultants
Greg Linneman
(573) 447-0292

f. McClure Engineering
Nick Allen
(314) 806-0091

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

2. SPECIAL SCHEDULING

Contractor may mobilize no earlier than [04/22/2024]

Contractor may begin on-site mobilization prior to approval of shop drawings and materials procurement.

Contractor shall perform all remediation work in the designated areas between [4/22/2024] and [08/01/2024].

Work shall be phased as indicated on drawings.

Normal working hours are defined as weekdays between the hours of [7:AM and 4:PM].

Excessive Noisy Work hours - All interior concrete demolition work shall be coordinated and approved at least [seventy two (72)] hours in advance with Owner's Representative.

Laboratory Work - All scope within labs shall be coordinated and approved at least [seven (7)] days in advance with Owner's Representative. Work shall be continuous in all labs to minimize down time.

Training- All crew members will receive indoctrination, training and testing during the mobilization phase. All project personnel (including MU and MU contractors that will be entering controlled areas) require Radiation Worker training and qualification and will be trained in a single session that is expected to take up to four hours. Reference Article 10 in General Conditions

Contractor to provide construction schedule with details pertaining to the order in which laboratories will be under construction - Refer to General Conditions 3.18

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 in the 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) Roofing: The work will include removal of the existing roofing materials/assemblies down to the roof decking. This includes but not limited to, slate tile, felts, flashings, low slope EPDM, and insulation boards. The project will include replacement in-kind for each roofing assembly including the removal of three (3) brick chimneys, removal and resetting of cap and coping stones and copper flashings. Removal of roofing materials will be limited to what can be replaced or dried-in daily with specified roof system underlayment. Upon completion of the full tear-off, installation of the slate materials will commence. Occupants will be allowed to utilize the building throughout the duration of the construction effort.

- (2) Hazardous material: Chase Environmental will be retained to observe the removal to test and categorize the waste material as it is removed. Chase is to then categorize the waste as non-contaminated for normal disposal by the GC, or as contaminated radiological waste to be packaged, removed and disposed of.
- (3) Structural: Provide reframing of roof structure removed for placement of the ERU. Provide framing support for the new roof fans. Provide framing for new roof access. Provide framing and sheathing over chimneys, original roof access, and original exhaust fans.
- (4) Mechanical: Consists of the installation of a centralized lab exhaust system. Existing fume hoods and other building exhausts will be tied into this system. Exhaust air venturi valves will be installed for each load to maintain the required airflow.
- (5) Electrical: Fume hood alarm monitors will be installed at existing fume hoods. The existing motor control center (MCC) will be removed, and new electrical infrastructure will be installed to support the mechanical scope of work.
- (6) Architectural: Ceiling tiles to be replaced as indicated on the drawings.

4. LOCATION

- a. Work shall be performed under this Contract on campus of the University of Missouri - Columbia, at **Schweitzer Hall, 503 S College Avenue, Columbia MO 65211**

5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner's Representative will furnish the Contractor a copy of executed Contract and a complete set of Drawings and Specifications in PDF format.
- b. The Owner will provide electronic data files to the Contractor for their convenience and use in progressing the Work and the preparation of shop drawings or other submittal requirements required for construction of the referenced project. The electronic data files shall reflect Construction Documents and Bid Addenda only. These files will be transmitted subject to the following terms and conditions:
 - (1) The Owner makes no representation as to the compatibility of these files with the Contractor's hardware or software.
 - (2) Data contained on these electronic files shall not be used by the Contractor or anyone else for any purpose other than as a convenience in progressing the Work or in the preparation of shop drawings or other required submittals for the referenced project. Any

other use or reuse by the Contractor or by others will be at their own sole risk and without liability or legal exposure to Owner. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the Owner and its consultants, contractors, agents, employees, and representatives that may arise out of or in connection with the use of the electronic files transmitted.

- (3) Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless the Owner and its consultants, contractors, agents, employees, and representatives, against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.
- (4) These electronic files are not contract documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. The Owner makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by the Consultant and the electronic files, the signed and sealed hard-copy construction documents shall govern. The Contractor is responsible for determining if any conflict exists. By use of these electronic files, the Contractor is not relieved of their duty to fully comply with the contract documents.
- (5) Because information presented on the electronic files can be modified, unintentionally or otherwise, the Owner reserves the right to remove all indications of ownership and/or involvement from each electronic display.
- (6) Under no circumstances shall delivery of the electronic files be deemed a sale by the Owner and no warranties are made, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall the Owner be liable for any loss of profit, or any consequential damages as a result of use or reuse of these electronic files.

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
 - (2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.4) for required submittal information.
- d. The Contractor shall submit to the Architect 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.5).
- e. The Contractor shall submit to the Owner's Representative all items referenced in the accompanying Closeout Log (1.E.6) 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 Ave Parking Structure . 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 General Services Building. 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 General Services Building.

- (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: Restrooms on 2nd floor only have been designated by the Owner's Representative for use by the Contractor will be available. Failure of the Contractor to maintain restrooms in a clean condition will be cause for the Contractor's discontinued use of the restroom.
- 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 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:

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

Any precautions that the owner or previous contractors have implemented for the protection of employees in the "permit required controlled space":

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.

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”)

There are no known “permit required confined spaces” within the project limits. Each contractor shall conduct a survey to confirm whether or not any confined spaces exist within the project limits. 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”; 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 the 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. Keep
- (2) Fence screening fabric shall be used on all perimeter fencing. Fabric shall be green 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 the 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 the 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.

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* of any item described in the Contract Documents will be allowed only prior to the receipt of bids provided that a request for approval has been 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.

11. CODES AND STANDARDS

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

12. PERMITS

- a. Before commencement of Boilers, Water Heaters or Pressure Vessels the Contractor must obtain an installation permit from the State of Missouri, Division of Fire Safety, Boiler and Pressure Unit as required by 11 CSR 40-2.010 through 11 CSR 40-2.065. The permit applications are available at <http://www.dfs.dps.mo.gov/programs/bpv/>

13. SPECIALTIES

- a. 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.

- b. 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.
- c. Final plantings will be by the Owner. The Owner will water and maintain all seed, sod and landscaping.
- d. 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.
- e. 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.
- f. Final plantings will be by the Owner. The Owner will water and maintain all seed, sod and landscaping.
- g. Owner furnished topsoil: The contractor shall place Owner provided topsoil and grade to the finish elevation as defined in the contract. The contractor will load and haul topsoil from the Owner's stockpile located within two (2) miles of the project site. The contractor is required to notify the Owner a minimum of five working days in advance of the needed topsoil. Topsoil shall be placed with rubber tracked equipment to minimize compaction. Placement shall be sequenced to minimize compaction and damage to the topsoil. Topsoil or subsoil damaged, contaminated, or compacted during topsoil placement shall be repaired or replaced as directed by the Owner's Representative. Hand work shall be required next to adjacent structures

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. ROOF CERTIFICATION AND WARRANTY REQUIREMENT

- a. The Contractor shall submit a copy of the University of Missouri Roof System Manufacturer's Certification for each proposed roofing system, within two business days following receipt of bids by the Owner. The Certification shall be submitted to the Owner and the Architect of Record and shall be manually signed by an authorized representative of Manufacturer of each proposed roofing system. Certification shall have original signature.
- b. The Contractor shall submit a sample copy of the Roof Manufacturer's Warranty for each proposed roofing system, within two business days following receipt of bids by the Owner, clearly labeled as "SAMPLE". The sample warranty(s) shall be submitted to the Owner and the Architect of Record.
- c. The Owner and Architect of Record will review both documents for compliance with the Contract Documents and will notify the Contractor with required modifications.
- d. Within two weeks following final inspection and acceptance of the roofing system(s) by the Owner and the roofing system manufacturer(s), the Contractor shall submit a manually signed standard warranty agreement, in the same form as the sample, provided and executed by the roofing system manufacturer for each roofing system provided. Standard warranty agreement(s) shall be of the duration specified in Division 7.
- e. University of Missouri three (3) year Contractor's Roofing/Flashing/Sheetmetal Guarantee shall be signed by the roofing contractor after final inspection and acceptance of each roofing system by Manufacturer and by Owner.

16. 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.

17. MODIFICATION TO INFORMATION FOR BIDDERS: BIDDERS STATEMENT OF QUALIFICATIONS

a. Information For Bidders

(1) Reference: Information for Bidders, Article 8.4

Insert new Article 8.4 to read as follows:

In addition to the Bidder's Statement of Qualifications, the Bidder must also submit evidence and meet the following qualifications:

The project requires the services of a prime contractor who has demonstrated success in completing process/power plant work in an operating plant environment with little or no interruption of plant operations.

(a) MINIMUM QUALIFICATIONS

- (i) The schedule for the project is aggressive and requires a contractor with a successful track record of managing projects with average monthly expenditures of more than \$1 million
- (ii) Successful completion of one project of similar type and scope.
- (iii) Successful completion of at least three projects of \$15-million or greater value. Submit references for the three most recent projects over \$15 million in value.
- (vi) Successful and sustained track record of effectively utilizing project/schedule management software for at least the last two years.

(b) QUALIFICATION SUBMITTALS

- (i) Submitted qualification packages should include the following information:
 - Project and Schedule Management
 - Experience managing projects with equal or greater schedule demands.
 - Demonstrated and consistent on time completion success
 - Project Organization / Personnel
 - Key project team members and their resume
 - Project team roles and responsibilities of team members
 - Reporting/accountability procedures

- Quality control program and procedures
- Organizational Support
 - Home office support
 - Labor and subcontractor relations
 - Submittal processing procedures
 - Material ordering/tracking/delivery procedures
 - Cost accounting support
 - Financial stability/capacity
 - Record of mentoring and supporting Minority/Women Business Enterprise subcontractor Participation

(ii) Packages must include the following items:

- Corporate Organizational Charts
- Project Organizational Charts
- Summary of Similar Projects
- Client References
- Resumes – resumes for each key individual proposed for the project, include position in the firm, project responsibility, education, license or registration and relevant experience over the last five years.
- Financial Statements and/or Evidence of Bonding Capacity
- Sample progress reports and schedules
- Brief Narratives indicating how the Contractor intends to manage this project, including subcontractors.

(c) QUALIFICATION PROCEDURE

(i) All qualification information and supporting materials must be submitted with your bid. Following the bid date, the Owner reserves the right to request additional information material to evaluate qualifications. Failure of the Contractor to demonstrate their ability to comply with these qualifications may be grounds for the Owner not recommending aware of the Contract.

18. 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.
- (2) **Hazardous Materials Activities**
Refer to Risk & Insurance Management for review, but at a minimum for low-risk contracts only: Contractor agrees to maintain, on a primary basis and at its sole expense, at all times during the life of any resulting contract the following insurance coverages, limits, including endorsements described herein. The requirements contained herein, as well as the University's review or acceptance of insurance maintained by Contractor is not intended to and shall not in any manner limit or qualify the liabilities or obligations assumed by Contractor under any resulting contract. Coverage to be provided as follows by a carrier with A.M. Best minimum rating of A- IX.
- (3) **Commercial General Liability** Contractor agrees to maintain Commercial General Liability at a limit of not less than \$5,000,000 Each Occurrence, \$10,000,000 Annual Aggregate. Coverage shall not contain any endorsement(s) excluding nor limiting Product/Completed Operations, Contractual Liability or Cross Liability. Contractor may satisfy the minimum liability limits required for Commercial General Liability or Business Auto Liability under an Umbrella or Excess Liability policy. There is no minimum per occurrence limit of liability under the Umbrella or Excess Liability; however, the Annual Aggregate limit shall not be less than the highest "Each Occurrence" limit for either Commercial General Liability or Business Auto Liability. Contractor agrees to endorse The officers, employees, and agents of The Curators of the University of Missouri as an Additional Insured on the Umbrella or Excess Liability, unless the Certificate of Insurance state the Umbrella or Excess Liability provides coverage on a "Follow-Form" basis.
- (4) **Business Auto Liability** Contractor agrees to maintain Business Automobile Liability at a limit not less than \$1,000,000 Each Occurrence. Coverage shall include liability for Owned, Non-Owned & Hired automobiles. In the event Contractor does not own automobiles, Contractor agrees to maintain coverage for Hired & Non- Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Liability policy.
- (5) **Workers' Compensation & Employers Liability** Contractor agrees to maintain Workers' Compensation in accordance with Missouri State Statutes or provide evidence of monopolistic state

- coverage. Employers Liability with the following limits: \$500,000 each accident, disease each employee and disease policy limit.
- (6) **Pollution Liability Contractor** agrees to maintain Pollution Liability at a limit not less than \$10,000,000 Each Occurrence, \$10,000,000 Annual Aggregate.
 - (7) **Contract Language** The officers, employees, and agents of The Curators of the University of Missouri are to be Additional Insured with respect to the project to which these insurance requirements pertain. A certificate of insurance evidencing all coverage required is to be provided at least 10 days prior to the inception date of the contract between the contractor and the University. Contractor/Party 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. The University reserves the right to require higher limits on any contract provided notice of such requirement is stated in the request for proposals for such contract.
 - (8) **Indemnification** 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 cause of action arising from the Contractor's operations. 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.

Failure to maintain the required insurance in force may be cause for contract termination. In the event the Agency/Service fails to maintain and keep in force the required insurance or to obtain coverage from its subcontractors, the University shall have the right to cancel and terminate the contract without notice. The insurance required by the provisions of this article is required in the public interest and the University does not assume any liability for acts of the Agency/Service and/or their employees and/or their subcontractors in the performance of this contract.

19. 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) Contractor Schedule: Contractor is responsible for the schedule, and he may provide with in-house personnel or hire a third party scheduling consultant. See Contractor Schedule Specification included in these documents.

20. 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.

21. MECHANICAL, ELECTRICAL, PLUMBING (MEP) PRE-INSTALLATION MEETING(S)

- a. Before the start of MEP installation, the Owner's Representative will convene an MEP pre-installation meeting. Meeting participants to include contractor (including MEP subcontractors), Owner's Representative and additional contractor and University operational staff invited by the Owner's Representative. Topics will include underground rough-ins, steam piping, chilled water piping, sprinkler piping, hot water piping, electrical system, duct, telephone/data wiring, control wiring. Additional meetings will be conducted as required for the review of coordination drawings and scope specific installations. Cross section drawings of corridor ceilings and other congested areas will be of highest priority and will be reviewed prior to the start of installations in the affected areas. Meeting minutes and sign-up sheet will be transcribed by contractor and distributed to attendees.

22. PROJECT MANAGEMENT/COMMUNICATION REQUIREMENTS

- a. The Contractor shall be represented at the site by both a competent full-time project manager and a full-time, competent superintendent with no other assigned duties or responsibilities from the beginning of the work until its final acceptance, unless otherwise permitted by the Owner's Representative. The superintendent for the Contractor for the general building work shall exercise general supervision over all subcontractors of any tier engaged in the work with decision-making authority of the Contractor.
- b. The Contractor shall use a current industry standard (Primavera, Microsoft Project, etc.) project scheduling software which provides as a minimum: Critical paths, milestones, estimated and actual start and completion dates, scheduled vs. actual progress, and detailed task and subtask breakdown. The following schedules shall be provided as a minimum and kept current: Overall project schedule, four- (4-) week look-ahead, and two- (2-) week look-ahead.
- c. The Contractor shall furnish on-site Internet access for use by his project manager and superintendent. The University is providing an on-line, secure project communications web site which will be used as a major method of communicating and storing project information. This web site will be used to communicate directed and group email, RFIs, change order requests and authorizations, and general correspondence. It will serve as a project message board, file storage and retrieval system, and will provide access to and storage of digital photos and contract documents and revisions.
- d. The Contractor shall provide at least two (2) job site FM handheld communication radios (walkie-talkies) for use by the on-site superintendent and the Owner's Representative, or the Contractor shall provide his on-site superintendent with a handheld cellular telephone.

23. SAFETY PRECAUTIONS AND PROGRAMS

- a. The Bidder's Statement of Qualifications includes a requirement that the Bidder provide its Worker's Compensation Experience Modification Rates (EMR) and Incidence Rates for the three recent years. The Bidder shall also include the EMR and Incidence Rates of listed major subcontractors on the Bid for Lump Sum Contract. If the EMR exceeds 1 or the Incidence Rate exceeds 13, the Contractor or major subcontractor shall take additional safety measures including, but not limited to, developing a site specific safety plan and assigning a Safety Manager to the Project to perform inspections on a schedule as determined acceptable by the Owner with written reports to be submitted to the Owner. The Owner reserves the right to reject a Bidder or major subcontractor whose rates exceed these stated rates.

- b. 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 to contact during or after hours in case of an emergency. This information shall be submitted within 15 days of the Notice to Proceed.

24. 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.

25. HOT WORK PERMITTING AND GENERAL REQUIREMENTS

- a. Hot work Requirements: The contractor shall comply with the following hot work requirements and the requirements of the International Fire Code and 2014 NFPA 51B.
- b. Hot work shall be defined as any work involving burning, welding, grinding, cutting, or similar operations that are capable of initiating fires or explosions.
- c. The Contractor shall utilize the hot work permit decision tree and permit provided in the 2014 NFPA 51B for all Hot Work operations.
- d. A hot work permit shall be used on all hot work performed outside a designated hot work area. The hot work permit shall be posted and clearly visible within proximity of the hot work area. The hot work permit authorizing individual (PAI) shall be as designated by the Contractor.
- e. Notify the Owner's Representative 24 hours prior to starting hot work in buildings with operational fire alarm or fire suppression systems. The Owner's Representative will coordinate the appropriate system outage with Campus Maintenance personnel.
- f. Unless otherwise instructed by the Owner's Representative, the Contractor shall post a copy of each completed hot work permit to the Owner's project management file system the following business day.
- g. *Special hot work requirements: Use thermal imaging cameras after hot work operations- describe criteria in detail (for historically significant buildings of wood construction); designate additional fire watch monitoring beyond the NFPA 30-minute post hot work requirement (project has a greater potential for reflash or smoldering fire due to concealed combustible building elements, etc.).*

26. GENERAL REQUIREMENTS FOR CRANE AND HOISTING OPERATIONS

- a. All crane and hoisting operations shall be performed in compliance with

OSHA 29 CFR 1926. All Operators, riggers, and signal persons must have the proper qualifications and training necessary to perform the intended hoisting activities for this project.

- b. Only fully certified and evaluated Operators shall perform equipment operations. Operators in an “Operator in Training” status shall not be used.
- c. Submittal requirements:
 - 1. Submit copies of Operator certifications, licenses, and evaluations to the Owners Representative.
 - 2. Submit Rigger and Signal Person qualifications to the Owners Representative.
 - 3. Unless otherwise directed by the Owners Representative, submit a lift plan, and conduct a lift coordination meeting for hoisting or crane operations for any lift greater than 2,000 pounds, or for any multi pick lift. Include protective measures for existing underground utilities, occupied buildings, pedestrian and vehicle pathways, adjacent buildings, and overhead power lines. If the lift is to occur over an occupied building, provide a registered structural engineer’s review and verification that the building can resist the impact of a dropped load for the intended lift. If evacuation of an occupied building is necessary to conduct the lift, the decision for building evacuation or scheduling the lift for off-hours will be determined by the Owner.

27. 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.

<https://operations.missouri.edu/facilities/contractor-information>

28. 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

SECTION 1.E.1

SCHEDULING SPECIFICATION

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 to 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.

Jan – 5 days	Feb – 5 days	Mar – 4 days	Apr – 4 days
May – 3 days	Jun – 3 days	Jul – 2 days	Aug – 2 days
Sep – 3 days	Oct – 4 days	Nov – 4 days	Dec – 5 days

2. SCHEDULING PROCESS

a. The intent of this section is to ensure 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 subcontractors 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 fragments 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 include 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 Contractor's 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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SECTION 1.E.2

UNIVERSITY OF MISSOURI

ROOFING SYSTEM MANUFACTURER'S GUARANTEE

(Rev. 10/2021)

(Manufacturer to complete applicable sections. Submit separate Guarantee form for each building and roofing system prior to issuance of the Notice to Proceed.

Roof System Manufacturer (RSM): _____

Address: _____

City, State, Zip: _____

Guarantee Administrator Telephone: _____

Guarantee Administrator Email: _____

Owner (Campus): _____

Building Name: _____

Address: _____

City, State, Zip: _____

Owner's Project No. and Name: _____

Roof Type: _____

Description of roof area (s):

Description of roof system components:

Guarantee Number: _____

Effective Date: The guarantee period commences on the date of the Roofing Manufacturer's and the Owner's final inspection and acceptance of the roof installation as provided in the contract documents. RSM to re-submit guarantee following final acceptance of the roof by Owner and RSM with the Effective and Expiration Dates entered.

Guarantee Duration: _____

Guarantee Expiration Date: _____

Roofing Contractor (Approved Installer): _____

Address: _____

City, State, Zip: _____

Telephone: _____

Email: _____

Guarantee:

In the event of a leak in the covered roof system prior to the guarantee expiration date, _____ (RSM) guarantees to the University of Missouri that _____ (RSM) will complete the necessary repairs and pay for all materials, labor and related expenses required to restore the roof to a watertight condition, provided such leaks are the result of defects in material, defects in workmanship in installing the roofing system or ordinary wear and tear. RSM further guarantees that permanent repairs shall be completed promptly or, if permanent repairs cannot be completed in a timeframe acceptable to the Owner, then RSM shall make temporary repairs. The University of Missouri will not be responsible for any expenses other than the Owner's incidental coordination resulting from covered repairs. There is no dollar limit on the covered repairs. Leaks caused by materials or components that are not part of the roofing manufacturers system are not covered under this guarantee.

The RSM shall notify the Owner 60 calendar days prior to the expiration of the guarantee period to ensure the Owner is aware of the expiration date.

Owner's Responsibilities:

The Owner shall maintain the roof in a reasonable condition and shall trim vegetative material such that it does not encroach on the roofing system. The Owner shall notify the RSM, or cause the RSM to be notified, in the event of any modification to the roofing system related to building work, structural changes, installation of roof mounted equipment or similar revisions. In the event of a failure to notify the RSM of such modifications, this guarantee shall remain in full force and effect provided RSM required repairs are completed to the affected area. In the event of a leak in the covered roofing system and prior to undertaking any repairs, the Owner shall promptly notify the RSM directly by email. RSM will respond within three working days with a proposed schedule

for inspecting and repairing the roof or providing temporary repairs. If an emergency condition exists as determined by the Owner which requires immediate repair to protect the building, occupants, or contents, Owner is authorized to complete such temporary repairs. The RSM shall reimburse the Owner for the reasonable cost of such repairs only to the extent those repairs are required to protect the building, occupants or contents.

Exclusions:

This guarantee does not cover leaks which occur as a result of the following:

1. Natural disasters including winds in excess of 90 MPH, hail, floods, earthquake, lightning or other extraordinary natural events.
2. Damage by fire.
3. Impacts by foreign objects.
4. Movement, cracking or settlement of the building.
5. Excessive foot traffic on the roofing system.
6. Chemical or solvent damage.
7. Failure by the Owner to maintain the roof in a reasonable manner.
8. Modifications to the roofing system discussed above.

This guarantee shall run concurrently with the Roofing Installer's Three-Year Roofing, Flashing, Sheet Metal Guarantee. The Owner shall have no duty to inspect the roof or commit to RSM inspections as a condition of this Guarantee. No modifications shall be made to this guarantee.

Guarantee Acceptance:

For ROOFING SYSTEM MANUFACTURER:

For THE CURATORS OF THE UNIVERSITY OF MISSOURI:

Name

Name

Title

Title

Date

Date

RSM Corporate Seal Affix Here:

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SECTION 1.E.3

CONTRACTOR'S ROOFING/FLASHING/SHEET METAL GUARANTEE

(Revised 12/94)

WHEREAS _____
herein referred to as Roofing Contractor, certify that they have furnished and installed all roofing, flashing, sheet metal and related components in accordance with the Contract Documents and as required by the Roofing System Manufacturer's installation instructions on the facility described below:

Facility: _____

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

Date of Full Completion: _____

Approximate Area of Roof: _____

Type of Roofing Material: _____

Manufacturer's Specification Number: _____

Thickness and Type of Roof Insulation: _____

NOW, THEREFORE, Roofing Contractor guaranties to the Owner, subject only to the exclusions stated hereinafter, that all roofing, flashing and sheetmetal work is fully and integrally watertight and is free from faults and defects in material or workmanship, and is guaranteed for a period of three (3) years from date of full completion of work.

EXCLUSIONS: This guarantee does not cover, and Roofing Contractor shall not be liable for the following:

1. Damage to the roofing system caused by fire, lightning, tornado, hurricane or hailstorm.
2. Damage to roofing system caused by significant settlement, distortion or failure of roof deck, walls, or foundations of building, excepting normal building expansion and contraction is not a part of this exclusion.
3. Abuse by the Owner and/or third parties.

REPAIRS: Owner shall promptly notify Roofing Contractor, in writing, of the need for repair of roofing, flashing, or sheet metal:

1. Roofing Contractor, within eight (8) hours after receipt of such notice, shall make emergency repairs at its expense, as required to render the facility watertight.
2. Within five (5) days after receipt of such notice, Roofing Contractor shall at its expense correct any faults or defects in material or workmanship.
3. Should needed repairs not be covered by this guarantee, Roofing Contractor, after having obtained Owner's written consent, shall make such repairs at Owner's expense. Following said repairs, this guarantee shall thereafter remain in effect for the unexpired portion of the original term. If Owner does not so consent or repairs are made by others than the Roofing Contractor, this guarantee shall terminate for those parts of the roof affected by the repair.

4. In the event that Owner has notified the Roofing Contractor of the need for repairs and (i) Roofing Contractor does not immediately make repairs, or (ii) Roofing Contractor disclaims responsibility for the repairs and Owner disagrees, or (iii) Owner considers Roofing Contractor=s quoted cost for repairs not covered by this guarantee to be unreasonable and, an emergency condition exists which requires prompt repair to avoid substantial damage or loss to Owner, then, Owner may make such temporary repairs as he finds necessary and such action shall not be a breach of the provisions of this guarantee.

ANNUAL INSPECTIONS: Roofing Contractor shall inspect roof installation prior to each of the three anniversary dates from date of full completion of the work.

1. Inspection team to include Roofing Contractor, Roof Manufacturer, and Owners Representative.
2. Inspection of total roof system will be included in the annual inspections.
3. All defects in total roof system will be corrected by the Roofing Contractor within 30 days of inspection.
4. Roof manufacturer will certify by a written report that roof inspection has been completed, defects are acknowledged, and will warrant any repairs.
5. All corrective work completed by Roofing Contractor shall be warranted as approved by the Roofing Manufacturer.

ROOF MODIFICATION: Should Owner require work to be done on roof of said facility including modifications, alternations, extensions or additions to roof and including installation of vents, platforms, equipment, bracings or fastenings, Owner shall notify Roofing Contractor and give Roofing Contractor an opportunity to make recommendations as to methods necessary to safeguard against damage to roofing covered by this guarantee. Failure of Owner to give Roofing Contractor such opportunity or failure to follow methods recommended by Roofing Contractor shall render this guarantee null and void to the extent such failure should result in damage to roofing covered by this guarantee.

NOTICES: Notification of Roofing Contractor by Owner, shall be fulfilled by sending notice to Roofing Contractor.

IN WITNESS WHEREOF, we set our hands this ____ day of _____, 20__.

By: _____

Title: _____

For Roofing Contractor

Name: _____

Address: _____

Phone: _____

SECTION 1.E.4

SHOP DRAWING AND SUBMITTAL LOG

Project: SCHWEITZER HALL – ROOF REPLACEMENT
 Project Number: CP231262
 Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date to Consultant</i>	<i>Date Returned</i>	<i>Comments</i>	<i>Uploaded to Projex4</i>
20 00 090	Basic Mechanical conditions							
20 10 13	Valves							
20 10 44	Seismic Restrain							
20 10 80	Testing and Balancing (TAB)							
20 10 90	Identification							
20 25 00	Insulation							
21 00 00	FIRE PROTECTION SYSTEM							
21 00 06	Shop Drawings							
21 00 20	Piping and Accessories							
21 00 22	Piping Materials and Fittings							
21 00 31	Sprinkler Heads							
22 00 00	PLUMBING WORK							
22 20 00	Piping Materials and Fittings							
20 30 00	Drains and Cleanouts							
23 00 00	HVAC PIPING AND EQUIPMENT							
23 10 00	Piping Materials and Fittings							
23 10 04	Hydronic Specialties							

23 82 01	Variable Volume Terminal Unit							
23 82 02	Fan Coil Units							
23 82 03	Lab Air Control Systems							
24 31 01 & 02	Sheetmetal Ductwork							
24 31 03	Sealing							
24 31 04	Fittings							
24 33 01	Balancing Damper							
24 33 02	Air Turning Vanes							
24 33 03	Flexible Connectors							
24 34 00	Fans							
25 00 00	JCI Control Systems (MU)							
1.04	All Items Listed							
26 00 00	ELECTRICAL							
26 27 26	Wiring Devices							
26 05 48	Seismic Restraint							
26 09 23	Lighting Control Devices							
26 28 16	Disconnects							
26 24 16	Panelboards and Circuit Breakers							
26 29 23	Variable Frequency Drives							
26 29 13	Motor Starters/RIBs							
26 51 13	Interior Light Fixtures							

SECTION 1.E.5

OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG

Project: SCHWEITZER HALL – ROOF REPLACEMENT
 Project Number: CP231262
 Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
20 10 44	SEISMIC RESTRAINT - AS BUILTS	x		x				
20 10 80	TESTING AND BALANCING	x						
21 00 21	VALVES	X						
21 00 31	SPRINKLER HEADS	X				X		
23 82 01	VARIABLE VOLUME TERMINAL UNITS	X	X	X	X			X
23 82 02	FAN COIL UNITS	X	X	X	X			X
23 82 03	LAB AIR CONTROL SYSTEMS	X	X	X	X			
24 34 00	FANS	X	X	X	X			X
25 00 00	TEMPERATURE CONTROLS PARTS & PIECES	X				X		
25 00 00	TEMPERATURE CONTROLS WIRING DIAGRAMS		X					
25 00 00	CONTROL DAMPERS	X		X	X			
25 00 00	CONTROL VALVES	X		X	X			

26 00 00	ELECTRICAL							
26 09 23	Lighting Control Devices	X	X					X
26 27 26	Wiring Devices	x						
26 28 13	Fuses	x						
26 28 16	Disconnects	x	x	x	x			
26 24 16	Panelboards and Circuit Breakers	x	x	x	x			
26 29 23	Variable Frequency Drives	x	x	x	x			x
26 51 13	Interior Light Fixtures	X						
26 29 13	Motor Starters/RIBs	x	x	x	x			x

SECTION 1.E.6

CLOSEOUT LOG

Project: SCHWEITZER HALL – ROOF REPLACEMENT
Project Number: CP231262
Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor / Subcontractor</i>	<i>Date Rec'd</i>	<i># of Copies</i>	<i>CPM Initials</i>	<i>Remarks</i>
20 10 44	SEISMIC RESTRAINT - AS BUILTS					
20 10 80	TESTING AND BALANCING					
21 00 14	TEST REPORT					
22 00 08	MISC CLOSE-OUT REQUIREMENTS					
22 20 01	PIPING MATERIALS AND FITTINGS					
23 00 05	PIPE PRESSURE TEST REPORT					
23 00 06	MISC. CLOSEOUT DOCUMENTS					
24 00 06	MISC. CLOSEOUT DOCUMENTS					
24 31 04	DUCTWORK LEAKAGE TESTING					
25 00 00	3.03 CLOSEOUT PROCEDURES					
26 00 00	ELECTRICAL					
26 27 26	Wiring Devices					
26 05 48	Seismic Restraint					
26 09 23	Lighting Control Devices					
26 28 13	Fuses					

26 00 00	ELECTRICAL							
26 09 23	Lighting Control Devices	X	X					X
26 27 26	Wiring Devices	x						
26 28 13	Fuses	x						
26 28 16	Disconnects	x	x	x	x			
26 24 16	Panelboards and Circuit Breakers	x	x	x	x			
26 29 23	Variable Frequency Drives	x	x	x	x			x
26 51 13	Interior Light Fixtures	X						
26 29 13	Motor Starters/RIBs	x	x	x	x			x

CP231262 Schwietzer Hall Roof Remediation Commissioning Log

Commissioning Items by CSI Division	Verified by:	Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
1							
Building System Commissioning							
Commissioning Agent - Conduct pre-installation meetings per specifications.						Meeting Minutes	<input checked="" type="checkbox"/>
24119							
Selective Demolition							
Do not start demolition until utility disconnect and sealing has been verified in writing							<input checked="" type="checkbox"/>
Hold Preinstallation meeting as specified						Meeting Minutes	<input checked="" type="checkbox"/>
45000							
Masonry Restoration							
Provide mock-ups per specifications.						Inspection Report	<input checked="" type="checkbox"/>
75323							
EPDM Membrane Roofing							
Perform Field Quality Control section of specifications						Test Report	<input checked="" type="checkbox"/>
75401							
EPDM Membrane Roofing							
Perform Final Roof Inspection (Manufacturer's Rep)						field report	<input checked="" type="checkbox"/>
79000							
Joint Sealers							
Build Mockup as specified						Inspection Report	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
Clean out joints immediately before installing joint sealant						<input checked="" type="checkbox"/>
201000						
Basic Mechanical Materials and Methods						
Hold MEP pre-installation meeting(s).					Meeting Minutes	<input checked="" type="checkbox"/>
201013						
Valves						
Test and adjust valves per specifications						<input type="checkbox"/>
201055						
Cleaning of Piping System						
Remove and clean all strainers after flushing system					Flush Report	<input checked="" type="checkbox"/>
201056						
Pressure Testing (Pipe)						
Pressure test piping per specifications					test report	<input checked="" type="checkbox"/>
201080						
Testing, Adjusting and Balancing						
Hold Prebalancing conference as specified					Meeting Minutes	<input checked="" type="checkbox"/>
Perform contractor Section of spec before TAB commences						<input type="checkbox"/>
Place outlet dampers in full open position						<input type="checkbox"/>

Verified by:						
Commissioning Items by CSI Division	Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
Provide a complete set of as-builts prior to testing						<input type="checkbox"/>
Supply control diagram					control diagram	<input type="checkbox"/>
Verify TAB Engineer notified of differences between design and installed equipment						<input type="checkbox"/>
201090						
Basic Mechanical Methods-Identification						
Install pipe markers per specifications						<input type="checkbox"/>
202510						
Insulation Materials						
Verify fire rating at fire dampers,walls, floors, ceilings and roof						<input type="checkbox"/>
210014						
Testing (Sprinkler)						
Perform Tesitng section of specifications					NFPA 13 Certification	<input checked="" type="checkbox"/>
210015						
Acceptance (Sprinkler)						
Perform Acceptance section of specifications. Including Dry pipe sprinkler system.					NFPA 13 Certification	<input checked="" type="checkbox"/>
230700						
Mechanical Insulation						
Verify all piping unions are accessible for maintenance						<input type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
237300						
Air Handling Units						
Provide factory training					Sign-In Sheet	<input checked="" type="checkbox"/>
Startup by factory representative					Startup Report	<input checked="" type="checkbox"/>
243100						
Sheetmetal Ductwork						
test for duct leakage per spec. Ducts shall meet leakage requirement prior to testing and balancing. Leakage class of 4 if no other specified.					test report	<input checked="" type="checkbox"/>
243300						
Air Distribution Accessories						
Demonstrate Proper Operation of All Fire Dampers per NFPA-90A.					Inspection report	<input checked="" type="checkbox"/>
250000						
Control Systems						
Check and record amp draw on supply transformers of I/O panels					Test Report	<input checked="" type="checkbox"/>
Ensure shipping material has been removed from thermostats and other control devices						<input type="checkbox"/>
Post laminated control diagram in mechanical room						<input type="checkbox"/>
Start, test and adjust controls and safeties						<input type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
260091						
Instructions of Owner's Representative						
Train all End Users on the equipment they will use on a periodic basis per Instructions of Owner's Rep section of specifications					Sign-in Sheet	<input checked="" type="checkbox"/>
260519						
Low-Voltage Electrical Power Conductors and Cables						
Ensure wires are color coded per specifications						<input type="checkbox"/>
260526						
Grounding and Bonding for Electrical Systems						
Conduct grounding tests per specifications					test reports	<input type="checkbox"/>
260923						
Lighting Control Devices						
Factory rep shall provide start-up Per spec.					field report	<input checked="" type="checkbox"/>
262413						
Panelboards						
Perform acceptance test per specifications					test reports	<input type="checkbox"/>
262726						
Wiring Devices						
Check all receptacles for proper operation						<input type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
262923						
Variable Frequency Drives						
Provide factory training					Sign-In Sheet	<input checked="" type="checkbox"/>
Test for harmonics, VFD startup and initial parameters set by Factory representative					Startup Report	<input checked="" type="checkbox"/>
265000						
Lighting						
Test Emergency Lighting fixtures for proper operation for 90 minutes					Test Report	<input checked="" type="checkbox"/>
265100						
Light Fixtures and Lamps						
Furnish extra material as specified					Transmittal	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>

Please see following website for suggested commissioning forms:

<https://operations.missouri.edu/facilities/commissioning-forms>

Construction Management Checklist for Energizing Utilities

(Contractor to initial each item upon completion and provide completed form to the Owner's Representative prior to energizing utility)

Page 1 of 2 (Updated 10/23)

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 & sensors properly installed, working, remote read operational, 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 for piping being turned on.
- Contractor has method to communicate "Services On" to other contractor personnel and Owner's personnel.
- Consultant has signed off.
- Permitting/Inspection authority has signed off and provided documentation of approval to energize.

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/water.
- Insulation must be installed.
- All hangers and bolts have been installed.
- Meter & sensors installed, working, remote read operational and in readable location.
- 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.
- Permitting/Inspection authority has signed off and provided documentation of approval to energize.

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/water.
- Insulation must be installed.
- 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.
- Permitting/Inspection authority has signed off and provided documentation of approval to energize.

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.
- Coordination & Arc Flash studies complete with owner approvals and appropriate labels installed on equipment being energized.
- GFCI set and tested.
- Breakers & remote operators set and tested per approved studies.
- All needed permanent grounds are installed.
- Meter installed, working and in readable location.
- Main switchgear protected from the weather/water.
- Contractor has method to communicate "Services On" to other contractor & Owner's personnel.
- Consultant has signed off.
- Permitting/Inspection authority has signed off and provided documentation of approval to energize.

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.
- Pressure test completed in piping being turned on.
- Insulation must be installed.
- Meter installed, working and connected to remote read.
- Building pump and automatic isolation/control valve must be installed and under control.
- If 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.
- Permitting/Inspection authority has signed off and provided documentation of approval to energize.

***Fill out all form fields before signing!**

Name _____ **Organization** _____ **Title** _____ **Signature** _____

_____ University of Missouri Commissioning Authority



(Place Digital Locking Stamp Here)

SECTION 1.F

INDEX OF DRAWINGS

Drawings referred to in and accompanying Project Manual consists of following sheets dated January 17, 2024.

SHEET NUMBER	SHEET TITLE
G001	SCHWEITZER HALL COVER SHEET
S1.00	SITE COORDINATION PLAN
A1.01	ROOFING DEMOLITION SCHEDULE
A1.02	ROOFING RENOVATION SCHEDULE
A1.03	ROOFING DETAIL SHEET 1
A1.04	ROOFING DETAIL SHEET 2
A1.05	ROOFING DETAIL SHEET 3
A1.06	PHOTOGRAPHIC VENT DETAIL SHEET
A1.07	HAZARDOUS MATERIAL AWARENESS PLAN
A200	INFECTION CONTROL & INDOOR CONSTRUCTION LOGISTICS
A201	GROUND FLOOR DEMOLITION RCP & NEW WORK
A202	FIRST FLOOR DEMOLITION AND NEW WORK RCP
A203	SECOND FLOOR DEMOLITION AND NEW WORK RCP
A204	ATTIC NEW WORK PLAN
S100	ATTIC FLOOR FRAMING PLAN AND DETAILS
S200	ROOF FRAMING PLAN AND DETAILS
M0.00	MECHANICAL SYMBOLS AND ABBREVIATIONS
DM3.00	GROUND FLOOR HVAC PLAN DEMOLITION PHASE 3
DM3.01	FIRST FLOOR HVAC PLAN DEMOLITION PHASE 3
DM3.02	SECOND FLOOR HVAC PLAN DEMOLITION PHASE 3
DM3.03	ATTIC HVAC PLAN DEMOLITION
DM3.04	ROOF HVAC PLAN DEMOLITION
DM5.00	AIR FLOW DIAGRAM DEMOLITION
M3.00	GROUND FLOOR HVAC PLAN NEW WORK PHASE 3
M3.01	FIRST FLOOR HVAC PLAN NEW WORK PHASE 3
M3.02	SECOND FLOOR HVAC PLAN NEW WORK PHASE 3
M3.03	ATTIC HVAC PLAN NEW WORK
M3.04	ROOF HVAC PLAN NEW WORK
M5.00	AIR FLOW DIAGRAM NEW WORK
M5.01	CONTROL DIAGRAMS
M5.02	CONTROL DIAGRAMS
M6.00	MECHANICAL SCHEDULES AND DETAILS
M8.03	ATTIC FIRE PROTECTION PLAN NEW WORK
E0.00	ELECTRICAL ONE LINE DIAGRAMS DETAILS AND SCHEDULES
E1.00	ELECTRICAL ONE LINE DIAGRAMS DETAILS AND SCHEDULES
E1.01	ELECTRICAL WIRING DIAGRAMS
E3.00	FLOOR PLANS – ELECTRICAL
E3.01	FLOOR PLANS – ELECTRICAL
E3.02	LIGHTNING PROTECTION

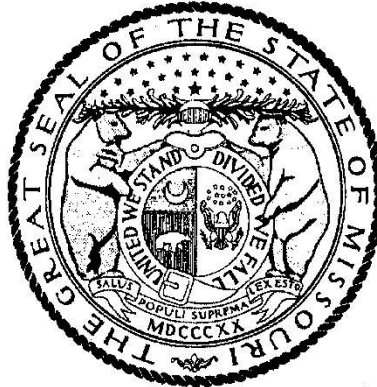
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Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 30

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

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 10, 2023**

Last Date Objections May Be Filed: **April 10, 2023**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$58.05
Boilermaker	\$73.87
Bricklayer	\$53.18
Carpenter	\$49.00
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$47.52
Plasterer	
Communications Technician	\$57.48
Electrician (Inside Wireman)	\$58.51
Electrician Outside Lineman	\$76.79
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$31.16*
Glazier	\$65.21
Ironworker	\$65.92
Laborer	\$42.86
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$31.16*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$64.73
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$40.26
Plumber	\$69.73
Pipe Fitter	
Roofer	\$53.14
Sheet Metal Worker	\$56.02
Sprinkler Fitter	\$61.21
Truck Driver	\$31.16*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMO Section 290.210.

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$53.37
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$76.79
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$46.32
General Laborer	
Skilled Laborer	
Operating Engineer	\$65.15
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$31.16*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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 fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 1.H

ALTERNATES

Base Bid may be increased in accordance with following Additive Alternate proposal(s) as Owner may elect:

1. Additive Alternate No. 1: **Fall Protection/Safety Rail**

A standard railing should consist of a top rail, intermediate rail and posts, and shall have a vertical height of 42 inches. The structure must have the strength to withstand at least the minimum requirement of 200 pounds, applied in a downward or outward direction within 2 inches of the top edge.

END OF SECTION

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SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.

1.02 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.03 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site

1.04 INFORMATIONAL SUBMITTALS

- A. Schedule of selective demolition activities with starting and ending dates for each activity.
- B. Predemolition photographs or video.

1.05 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- E. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.06 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned.
 - 1. Owner will arrange to shut off all utilities in area of work including electric, fire sprinkler, and antennas. Fire sprinkler piping is the only utility to be removed by contractor.

3.03 PROTECTION

- A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.04 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 4. Maintain fire per requirements set forth in the hot work permits (see division #1).
 - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Store items in a secure area until delivery to Owner.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition [and cleaned] and reinstalled in their original locations after selective demolition operations are complete.
- E. Pitch pocket metal, sealants, roof membrane and insulation to be removed as required.

3.05 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Special Conditions Section.
- B. Burning: Do not burn demolished materials.

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SECTION 04 0650 - MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 9000 - Masonry Restoration and Cleaning: Repointing and re setting existing masonry.

1.03 REFERENCE STANDARDS

- A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements For Masonry Structures; American Concrete Institute International.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International.
- C. ASTM C 5 - Standard Specification for Quicklime for Structural Purposes.
- D. ASTM C 91 - Standard Specification for Masonry Cement.
- E. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
- F. ASTM C 150 - Standard Specification for Portland Cement.
- G. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- H. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
- I. ASTM C 387/C 387M - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
- J. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- K. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

1.04 SUBMITTALS

- A. See Section 1.E - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C 270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C 270 and test and evaluation reports per ASTM C 780.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Masonry Cement: ASTM C 91, Type N.
 - 1. Colored mortar: Premixed cement as required to match Architect/Engineer's color sample.
- B. Portland Cement: ASTM C 150, Type I - Normal; color as required to produce approved color sample.
- C. Packaged Dry Mortar: ASTM C 387/C 387M, **Type N, using gray color cement.**
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Quicklime: ASTM C 5, non-hydraulic type.
- F. Mortar Aggregate: **ASTM C 144. Type S.**
- G. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C 979.
 - 1. Color(s): To match Architect/Engineer's sample(s) when incorporated into specified mix design(s).
- H. Water: Clean and potable.
- I. Accelerating Admixture: Nonchloride type for use in cold weather.

2.02 MORTAR MIXES

- A. Mortar for Unit Masonry: ASTM C 270, Property Specification.
 - 1. Pointing and coping mortar: Type S

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C 270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install mortar to requirements of Section 04 9000 - Masonry Restoration and Cleaning.

END OF SECTION 04 0650

SECTION 04 5000 – MASONRY RESTORATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings, and general provisions of the Contract including General and Supplementary Conditions and Specification Section applies to the work of this section.
- B. The extent of work is shown in the drawings and keynotes.
- C. Unit Prices: Additions and deletions from the quantities shown on the drawings shall be executed under Unit Prices. Obtain authorization of the Architect before proceeding with any additions under unit price work. The following work items are covered by unit costs:
 - 1. 04 5500 Unit Price 1: Provide price per linear foot in addition to suggested area.
 - 2. 04 5500 Unit Price 2: Remove and rebuild loose cracked and budging face brick areas. Price/sq ft.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Rake out all existing control joints and provide sanded sealant joint carefully matched to the appearance of the mortar joints (width, color, profile).
 - 2. Remove and replace all stone copings, port copings and ornamental stone throughout the building envelope perimeter. Inspect existing clip angles and steel dowels prior to re installation.
 - 3. Prep and level existing mortar bed joints to receive through wall flashing and accommodate resetting of coping stones.
 - 4. Installation of copper through wall flashing in sealant.
 - 5. Installation of continuous cotton weeps.
 - 6. Install sealant with backer rods at joints of all existing coping stones.
 - 7. Power wash and remove efflorescence when completed.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 4 “Masonry Restoration and Cleaning for masonry cleaning.
 - 2. Division 4 “Unit Masonry” for additional quality control requirements, which shall apply as if restated in full in this Section.
 - 3. SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

1.03 INTENT

- A. To provide a sound and watertight building shell utilizing repair methods and materials that are compatible with the physical characteristics of the existing materials and which visually blend with the surrounding materials when viewed from twenty (20) feet.

1.04 QUALITY ASSURANCE

- A. Masonry restoration specialist: Work shall be performed by a firm having not less than five years successful experience in comparable masonry restoration projects and employing personnel skilled in the processes and operations indicated and required.
- B. Field – Constructed Mock – Ups: Prior to start of general masonry restoration, prepare the following mock-ups on building surfaces where directed by Consultant. Obtain Architect’s acceptance of visual qualities before proceeding with the work. Mock-ups will be used to measure standard of workmanship, finish, texture, color and qualifications of workman. Repeat mock – up procedure as required until Architect’s acceptance is obtained. Protect and mark acceptable mock – ups, retain in undisturbed condition during construction to be used as a standard for judging completed work.

1. Repointing:
 - a. Brick: One sample demonstrating cutting out of mortar joints. One sample for demonstrating the color of the mortar, tooling and finishing of the joints. Each sample shall be ten (10) square feet.
 - b. Sealant at existing control joint: One sample ten (10) feet long with sanded finish.
 2. Sanded sealant: Prepare sample in stages. Cut control along 5 lineal feet of mortar joint. Rake of to required depth along 2 feet. Provide backer rod along 3 feet and install sealant and sand along 2 of the 3 feet. The intent of this repair is to exactly match the appearance of the adjoining repointed mortar and control joints.
 3. Coping: One sample section roughly 10' long with copper through wall flashing. Mortar bed and stone installation.
 - a. Remove and replace all stone copings, port copings and ornamental stone throughout the building envelope perimeter. Inspect existing clip angles and steel dowels prior to re installation.
 - b. Installation of cotton weeps.
- C. Any joints that develop hairline cracking, become unbonded, are friable after a seven-day cure period, or are otherwise defective in the opinion of the Architect, shall be cut out and repointed at no cost to the Owner.

1.05 SUBMITTALS

- A. Samples: Submit prior to mock-up samples for inspection by the Architect of each type of brick, lime, cement, aggregate, grout, adhesive, patching material, sealant, flashing, and colorant proposed for use. Provide unopened container of each material with manufacturer's original labeling. Also submit samples of each type of attachment anchor proposed for use.
 1. All brick for repairs shall be existing undamaged brick or brick salvaged for the portions of the building to be demolished.
- B. Product data: Submit manufacturers' technical data and Materials Safety Data Sheet for each product specified or proposed for use including recommendations for their application and use.
- C. Field Measurements: The Contractor shall take all necessary field measurements prior to fabrication and installation of work and shall assume complete responsibility for accuracy of same.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers. Store materials only in designated areas.
- B. Protect materials during storage and construction. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage. Store material only in the area designated by the Owner.
- C. Deliver materials at such time as to assure continuity of installation. Store and handle units at project site or staging area with care to prevent chipping, cracking, distortion, and warping, staining, or other damage.

1.07 PROJECT CONDITIONS

- A. Environmental requirements: Masonry rebuilding, repointing, and patching may be carried out only when air temperatures are 45F⁰ and above and will remain 40F⁰ for not less than 14 days after completion of work.
- B. Prevent mortar coatings from staining surrounding masonry. Remove any spill immediately. Protect sills, ledges, and other projections from mortar droppings by coating them with sand. No spills shall be permitted to remain at the end of each work day.
- C. Protect all new mortar from contact with rain for 24 hours. Cover work at end of each day and whenever work is not in progress. Extend waterproof covers securely over work area.

- D. Protect persons, motor vehicles, all building surfaces including but not limited to roofing and flashing, walls, parapets, and doors and related fixtures, signs, light standards, all metals, fittings, and equipment of the building and building site, sidewalks, landscaping, and related materials from damage. Protect landscaping at this building and site.
 - 1. In the event of damage, make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- E. Shore as required to complete the work and protect all masonry to remain. Removal and rebuilding shall be done in limited sections so as not to compromise in any way the structural stability of the building. Provide temporary watertight protection to all open work areas. The contractor shall provide a work plan detailing the staging of the work and other measures to protect the building and adjacent areas.

1.08 SEQUENCING/SCHEDULING

- A. Perform masonry restoration work in the following sequence in any give location:
 - 1. Clean masonry.
 - 2. Remove masonry, install new bricks, and rebuild masonry.
 - 3. Rebuild areas of cracked and displaced masonry.
 - 4. Perform additional repairs including repointing, patching, and paint removal.
 - 5. Rework control joints by removing caulk sealant and backer rod, install new backer rod and DOW 790 joint.

1.09 GUARANTEE

- A. Provide written warranty ensuring that all replacement masonry units, patching materials, rebuilt work, sealants and mortar joints that are determined to become displaced, cracked, spalled, hairlined, delaminated, discolored or otherwise unacceptable within a period of two (2) years from the date of substantial completion will be replaced in a manner conforming with the requirements of this specification.

PART 2 – PRODUCTS

2.01 MORTAR MATERIALS

- A. Portland Cement, Type I ASTM C 150, Portland Cement. Cement shall comply with ASTM C 91, not more than 0.30 % water soluble alkali.
- B. Type N Mortar: Mix to the Property Specifications of ASTM C 27 0:
 - 1. Compressive Strength: 750 psi, minimum, at 28 days for laboratory mixed mortar with a flow of 110 plus/minus 5 percent.
 - 2. Water Retention: 75 percent, minimum.
 - 3. Air Content: 12 percent, maximum.
 - 4. Aggregate Ratio: No less than 2.25 and no more than 3.5 times the sum of the separate volumes of cementitious materials.
- C. Type O Mortar: Mix to the Property Specifications of ASTM C 27 0:
 - 1. Compressive Strength: 350 psi, minimum, at 28 days for laboratory mixed mortar with a flow of 110 plus/minus 5 percent.
 - 2. Water Retention: 75 percent, minimum.
 - 3. Air Content: 12 percent, maximum.
 - 4. Aggregate Ratio: No less than 2.25 and no more than 3.5 times the sum of the separate volumes of cementitious materials.
- D. Hydrated Type S Lime for Masonry Purposes, ASTM C 207. Air entrained lime shall not be used.
- E. Mortar Aggregate: Well-graded sharp bagged mason’s mortar sand, ASTM C 144.

- F. Water shall be clean and free from deleterious materials. Only potable water may be used.
- G. Mortar Pigments. Iron oxide pigments manufactured by SGS (Solomon Grind Chem.). Color 10 H Light Buff.
 - 1. Pigments to match the color of the original mortar. Measurements of pigments shall be accurate, and record shall be made of exact amount of pigment added to each approved mix.
- H. Matching new construction: Mortar used to repoint existing building to remain shall be of the same composition, joint detail and appearance and face mortar used in the new construction specified under Section 04200 "Unit Masonry". Provide Type N or O mortar for all repointing and repairs.

2.02 MASONRY UNITS

- A. Coping Stone: Salvage from the existing building section only.

2.03 SEALANT

- A. Sealant Type A:
 - 1. For exterior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
 - a. Control and expansion joints in coping joints.
 - b. Control and expansion joints in unit masonry.
 - c. Butt joints between metal panels.
 - d. Joints between brick and/brick.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors, windows, louvers and similar openings.
 - g. Control and expansion joints in overhead surfaces.
 - 2. Provide single-component, low-modulus, neutral cure, non-sag sealant; comply with ASTM C920, Type S or M, Grade NS
 - 3. Acceptable sealant:
 - a. Silicones
 - 1. Single Component
 - 1) Dow Corning 790
 - 2) Fire resistant
- B. Sealant Type B:
 - 1. For exterior joints in vertical and horizontal surfaces between metal window frames and pre-cast concrete tilt-up panel surfaces and between windows and metal window frames
 - 2. Acceptable products:
 - a. Dow Corning 795 Sealant
- C. Primers as recommended by manufacturer of sealant.
- D. Closed cell polyethylene backer rod of sizes required to allow for a secure fit without over compression.

2.04 CLEANERS

- A. Cleaner for Removing Light to Moderate Atmospheric Staining from Dense Masonry: PROSOCO Light Duty Restoration Cleaner; clear, gelled liquid, with following characteristics:
 - 1. pH: 1.6.
 - 2. Specific Gravity: 1.124.
 - 3. Flash Point: None.
 - 4. Weight: 9.34 lb/gal (1.119 kg/L).
- B. Cleaner for Removing Heavy Soiling from Acid-Sensitive Limestone and Masonry: PROSOCO Limestone & Masonry Prewash; semi-liquid non-acidic gel, prepared at 1:5 dilution, with following characteristics:
 - 1. pH: 13.6.

2. Specific Gravity: 1.274.
 3. Flash Point: None.
 4. Freeze Point: Minus 20 degrees F (minus 29 degrees C).
 5. Weight: 10.6 lb/gal (1.270 kg/L).
- C. Cleaner for Removing Light to Moderate Dirt and Mildew from Calcium-Based Stone: PROSOCO Limestone Restorer; clear light amber liquid, prepared at 1:6 dilution, with following characteristics:
1. pH: 0.1.
 2. Specific Gravity: 1.141.
 3. Flash Point: None.
 4. Freeze Point: Minus 40 degrees F (minus 40 degrees C).
 5. Weight: 9.49 lb/gal (1.137 kg/L).
- D. Cleaner for Removing Mold, Mildew, and Atmosphere Stains: PROSOCO BioKlean(tm) Kit; three-component, with following characteristics:
1. Cleaner: White powder.
 - a. pH: 11.78, in solution.
 - b. Specific Gravity: 1.060.
 - c. Flash Point: None.
 - d. Density: 8.81 lb/cu ft (144 kg/cu m).
 2. Activator: Clear liquid.
 - a. pH: 14.0.
 - b. Specific Gravity: 1.584.
 - c. Flash Point: None.
 - d. Density: 7.45 lb/cu ft (119 kg/cu m).
 3. Afterwash: Tan powder.
 - a. pH: 1.65, in solution.
 - b. Specific Gravity: 0.896.
 - c. Flash Point: None.
 - d. Density: 7.45 lb/cu ft (119 kg/cu m).
- E. Restoration Cleaning: Refer to Section 04900 for masonry restoration cleaners.

2.05 CAST STONE REPAIR

- A. Jahn M 70 Stone Patching Mortar, color and texture to match cleaned sample of existing.

2.06 WATER REPELLENTS

- A. Water Repellent: PROSOCO Weather Seal Siloxane; clear penetrating liquid oligomeric siloxane (active substance), with 5.8 percent active substance and the following characteristics:
1. VOC Content: Less than 760 g/L.
 2. Flash Point: 108 degrees F (42 degrees C).
 3. Specific Gravity: 0.793.
 4. Weight: 6.6 lb/gal (0.791 kg/L).

2.07 SHEET METAL FLASHING AND TRIM

- A. Through wall copper set in bed of sealant.
- B. Reference Section 07 6200

PART 3 – EXECUTION

3.01 INSPECTION AND ACCEPTANCE

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptance of working conditions.

3.02 MASONRY REPOINTING

- A. Joint preparation.
 - 1. Protect surrounding elements from damage due to restoration procedures.
 - 2. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
 - 3. Separate areas to be protected from restoration areas using means adequate to prevent damage.
 - 4. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
 - 5. Close off adjacent occupied areas with dust proof and weatherproof partitions.
 - 6. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area and traffic route.

- B. Mortar preparation and mixing.
 - 1. The lime, cement and sand should be carefully measured and well mixed together dry. Any pigment should be added in measured quantities and well dispersed into the other materials. Mortar shall be mixed in small batches so that it will be used within one hour after preparation.

- C. Mortar proportions for repointing and rebuilding/resetting shall be ASTM C 270 Type N mortar by proportion specification.
 - 1. Mortar proportions: Provide ASTM C 270 Type N mortar by proportion specification:
 - a. 1 Part by volume Portland Cement
 - b. 1 Parts by volume Lime
 - c. 6 Parts by volume sand, as measured damp. If dry sand is used, compensate volume for expansion of damp sand.

- D. Joint filling. Mortar should be packed in thin layers, not exceeding 1/2". Compact and allow each layer to become thumbprint hard before installation of new lift. Filled joints should be tooled to match the original joint profile. No mortar shall extend onto the face of the units.

- E. Damp Cure mortar. Mist mortar for at least 4 hours after tooling. In windy or hot weather, review cure procedures with the Architect to ensure that mortar does not cure excessively fast.

- F. Clean-up excess mortar at all areas repointed or rebuilt. Excess mortar should be removed from the surface before it sets using a bristle brush or by rubbing the surface with burlap or clean sand. Dried mortar shall be removed with chemical mortar remover.

3.03 LINTEL REPLACEMENT AND REBUILDING-N/A

- A. Remove masonry as required to replace lintel and to provide adequate bearing for new work. Extend removal area to include all cracked brick adjoining end of lintel.

- B. Install replacement lintels and flashing per drawings.

- C. Replace brickwork, fully replicating original coursing, joint pattern, and layout. Coursing pattern to match and blend with the surrounding existing masonry. Maintain overall dimension, joint sizes and joint alignments.

- D. Lay masonry units in full beds of mortar. Fill all bed, head, and collar joints. Pre wet back-up bricks prior to laying to ensure that the units are saturated, but without standing water on the surface.

3.04 MORTAR REPLACEMENT WITH SEALANT

- A. Cut or rake mortar joint along existing crack to a depth of 1 ½” using a single blade diamond saw along the midline of the joint. Existing crack “jumps courses” not at the joint line. Extend cut along the full perimeter, extending from the location of the end of the cracked area.
- B. Cleanly remove mortar to a depth of ½” deep providing a square back.
- C. Install backer rod and fill joint with sealant, tool sealant to match mortar joint detail.
- D. Before sealant skins over, broadcast mortar sand to cover joint surface.

3.05 ADDITIONAL REPAIR

- A. Cracked and displaced brick: Where shown in the pre bid walk through, remove and replace cracked and displaced brick. Reset all areas where loose bricks are uncovered during repointing operations. Finish tool all rebuilt work to match original joint detail and to blend fully with adjoining areas.

END OF SECTION 04 5000

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SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Patching of roof deck. IE; removed chimneys and vent stacks.

1.02 RELATED REQUIREMENTS

- A. Section 07 3150 - Slate shingles.
- B. Section 07 5400 - EPDM Membrane and Insulation.
- C. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

- A. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce).

1.04 SUBMITTALS

- A. See Section 1.E - Special Conditions, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including shims, bracing, and blocking.

3.02 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.03 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.04 CLEANING

- A. Waste Disposal: Comply with the requirements of Owner.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on the project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 1000

SECTION 07 3150 - SLATE SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Slate roofing shingles.
- B. Water-resistant underlayment.
- C. Fasteners and accessories
- D. SCOPE OF WORK – SCHWEITZER HALL: The scope of work includes the complete removal of the existing Slate Tile roof system and all allied components down to the existing wood deck. Installation of Synthetic Shark Skin Ultra throughout steep slope section. Installation of Ice and water shield membrane to the existing wood deck along gutter edge and valleys. Installation of new Slate Tile roof shingles to include all accessory items such as gutters, valleys, through wall scuppers, copper drip fascia, new through wall stone coping detail, flashing around all penetrations and equipment curbs, gutter guards and an approved snow guard system.
- E. All portions of the removal process will be tested for Radioactive (RAD) elements during the project.
- F. Contractor responsible for facilitating “copper” sheet metal scope of work.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood attachment members (nailers, etc.).
- B. Section 07 6200 - Sheet Metal Flashing and Trim.
- C. Section 07 7200 - Roof Accessories: Snow guards.
- D. Section 26 4113 – Lightning Protection for Structures
- E. Section 04 5000- Masonry Restoration: Stone Coping.

1.03 REFERENCE STANDARDS

- A. Comply with applicable requirements of the most recent editions of the following standards and others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. National Slate Association – *Slate Roofs: Design and Installation Manual*, 2010 Edition.
 - 2. ASTM C406 – Standard Specification for Roofing Slate.
 - 3. ASTM D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in roofing and waterproofing.
 - 4. ASTM D4869 – Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
 - 5. ASTM D1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 6. ASTM E108 / UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.
 - 7. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
 - 8. ASTM D3161 – Standard Test Method for Wind-Resistance of Steep Slope Roofing Products.
 - 9. FM Approvals 4473 Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls.
 - 10. FM Approvals 4475, Class 1 Steep Slope Roof Covers, Section 4.1.1 – Approved Wind Speed Categories for Roof Covers.

1.04 SUBMITTALS

- A. Submittals shall be made in accordance with the following.

- B. Product Data
 - 1. Underlayment(s) and underlayment fasteners. Product data for the roof underlayment must include the ASTM Standard to which it complies.
 - 2. Slate shingles and slating nails.
 - 3. ASTM C406 test results for specified slate (including ASTM C120, *Flexure Testing of Slate* (Breaking Load), ASTM C121, *Water Absorption of Slate*, and ASTM C217, *Weather Resistance of Slate*).
 - a. Testing must be conducted in accordance with the most recent version of these standards.
 - b. Test results must be less than 2-years old and be conducted on slate from the quarry from which the slate is to be obtained.
 - c. Testing shall be conducted by and reported on the letterhead of an NSA approved testing laboratory – see NSA’s website, www.slateassociation.org for approved labs.
 - 4. Provide Letter of Confirmation from the quarry/distributor certifying that slate being provided was produced in the region specified in Part 2 of this Section.
- C. Samples
 - 1. Three slate shingles of each color, showing the full, natural range of color variation to be expected in the finished work.
 - 2. Slating nails.
- D. Shop drawings

1.05 QUALITY ASSURANCE

- A. The work of this Section shall comply with applicable standards indicated or implied.
- B. Provide products in each color from a single quarry during the Work for consistency of quality and appearance.
- C. Slate roofing contractor shall have at least 10-years’ experience in the installation of new slate roofing/repair of existing slate roofing and shall have successfully completed at least three slate roofing projects within the past five years similar in scope and scale to the Project specified herein. Foreman or superintendent shall have similar experience and shall provide full-time supervision of installers.

1.06 TEST PANELS

- A. Prepare the following slate roofing test panels in an area and size designated by the Architect, or as indicated below, to verify selections made under sample submittals and to demonstrate aesthetic effects and quality standards of materials and execution.
 - 1. Installation of slate shingles at roof eave (starter, first, second, and third course), including underlayments, drip edge metal, and cant for slate, 5 linear feet.
 - 2. Installation of slate shingles at open valley, 3 to 4 courses at 1 valley.
 - 3. Slate shingle roofing, 100 square feet.
 - a. These test panels shall be completed only after the test panels listed above are reviewed and approved by the Design Professional.
 - 4. Hip slates with copper hip-cap, 3 to 4 linear feet of hip.
 - 5. Ridge slates with copper ridge-roll, 3 to 4 linear feet of ridge.
- B. Modify test panels as required to produce acceptable work in compliance with this specification and meeting the approval of Design Professional.
- C. Do not proceed with the remaining work until test panels are approved, in writing, by the Design Professional.
 - 1. Approved test panels shall be left in place and incorporated into the final construction.
- D. Approval of test panels does not constitute approval of deviations from the Contract Documents contained in the panels, unless such deviations are specifically approved, in writing, by the Design Professional.
- E. Coordinate test panels specified herein with each other and with those specified in other sections as required.

- F. Group test panels to the maximum extent possible such that Architect may review multiple test panels from this and other specification sections in the course of a single site visit.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Ensure the availability of adequate off-loading equipment and manpower at the job site for the mode of delivery used, and storage space for the quantity of slate shingles to be received.
- B. Deliver slate shingles to project site in pallets with each labelled with the source, size, quantity, and color contained in each pallet.
- C. Slate shingles shall be packaged on edge and separated by wood lath or other rigid material if rows are stacked vertically in the pallet.
- D. During extended periods of storage on site, tarp or otherwise cover the pallets to keep the shingles clean and prevent them from freezing together during cold weather.
- E. Store pallets at site on a solid, level surface and handle shingles to prevent chipping breakage, soiling or other damage.
- F. Load slate shingles on the building in a manner to avoid damage to the roof deck, structural supporting members, staging and scaffolding.
- G. Store accessory materials including nails, slate hooks, underlayment, and ice dam protection membrane according to the manufacturer's recommended storage instructions.

1.08 WARRANTY

- A. Closeout Submittals, for additional warranty requirements.
- B. Provide warranty against defective materials and workmanship, including related metal flashings, for a period of 10 years after final acceptance. Provide for replacement of defective work at no additional cost to Owner.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Ensure the availability of adequate off-loading equipment and manpower at the job site for the mode of delivery used, and storage space for the quantity of slate shingles to be received.
- B. Deliver slate shingles to project site in pallets with each labelled with the source, size, quantity, and color contained in each pallet.
- C. Slate shingles shall be packaged on edge and separated by wood lath or other rigid material if rows are stacked vertically in the pallet.
- D. During extended periods of storage on site, tarp or otherwise cover the pallets to keep the shingles clean and prevent them from freezing together during cold weather.
- E. Store pallets at site on a solid, level surface and handle shingles to prevent chipping breakage, soiling or other damage.
- F. Load slate shingles on the building in a manner to avoid damage to the roof deck, structural supporting members, staging and scaffolding.
- G. Store accessory materials including nails, slate hooks, underlayment, and ice dam protection membrane according to the manufacturer's recommended storage instructions.

1.10 PROJECT/SITE CONDITIONS

- A. Prior to beginning work, Contractor shall secure approval from the Owner for the following:
 - 1. Areas permitted for personnel parking.
 - 2. Access to the site and hours for construction activity.
 - 3. Areas permitted for storage of materials and debris.
 - 4. Areas permitted for the location of cranes, hoists, and chutes for loading and unloading materials to and from the roof.
- B. Interior stairs or elevators may not be used for removing debris or delivering materials to the roof or ground.
- C. Contractor employee access shall not be permitted to the interior of the building. Building access approval shall be obtained from the Owner.
- D. Exterior sanitary facilities are required and shall be provided by the Contractor.
- E. An exterior water source and electricity shall be provided by the Owner.
- F. The buildings shall remain occupied during construction. During the full course of the Work, the Contractor shall ensure that all pedestrian access points, including all entrances, foot paths, sidewalks, emergency means of egress, and vehicle access routes, shall be protected and display clear signage where barricades and construction fencing are employed. Do not block fire exits or impede ADA access.
- G. If discrepancies are discovered between the existing conditions and those noted on the Drawings, immediately notify the Architect in writing, and obtain written approval prior to commencing the Work. All necessary steps shall be taken to make the building watertight until the discrepancies are resolved.
- H. Proceed with the Work as weather conditions permit and/or as required by manufacturer's installation instructions or warranty requirements.
- I. Proceed with slate shingle roofing installation only after substrate construction, vent stacks, and other roof penetrations are complete, when substrate materials are dry, and weather conditions are appropriate.
- J. The Contractor shall ensure that work areas as well as the entire building are completely protected from water infiltration and remain watertight throughout the course of the project and water does not flow beneath any completed sections of the slate roof system.

1.11 WARRANTY

- A. **Slate Shingle Supplier Warranty:** Submit slate shingle supplier warranty, signed by the supplier and covering the slate shingles described in this Section, in which the supplier agrees to replace slate shingles that fail in materials and deliver the replacement slate to the original point of destination. The duration of this warranty shall be 10 years from date of original supply.
- B. **Roofing Installer Warranty:** Submit roofing installer warranty, signed by roofing installer and covering Work of this Section, in which the roofing installer agrees to repair or replace slate roofing that fails in materials or workmanship within the following warranty period.
 - 1. **Warranty Period:** Five years from date of substantial completion
- C. **Additional Roofing Installer Warranty:** The roofing installer agrees to return to the job site one year from the date of substantial completion of the to replace any broken or missing slates created because of normal, installation-related, shedding.

- D. The Contractor shall be responsible for all slate breakages on the project, prior to project closeout. After project closeout, the slate repair responsibilities of the Contractor shall be as set forth in the project contract and warranty documents.
- E. All exterior means of access required to perform the Work on the subject building as described in the project documents, shall be the responsibility of the roofing contractor. All access shall fully comply with all local, state, and OSHA safety codes and requirements.

1.12 SEQUENCING/SCHEDULING

- A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Coordinate work of this Section with interfacing, adjoining, and related roofing work for proper sequencing of each installation.
- B. Do not disrupt activities in occupied spaces.
- C. When multiple trades are accessing the same work area, coordinate the work sequence so as not to hinder the project schedule or detract from the quality of the work.
- D. The Owner shall reserve the right to close the jobsite to construction activities if those activities conflict with building schedules. The Owner shall provide as much notice as possible of any work disruptions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Slate Shingles:
 - 1. North Country Slate.
 - 2. Taran Brothers Slate.
 - 3. Greenstone Slate.
 - 4. Substitutions: See Section 1.E - Special Conditions.

2.02 ROOFING MATERIALS

- A. Slate Shingles: Hard, dense, sound rock, free of ribbons, and drilled or punched with two nail holes per shingle, located for proper head lap.
 - 1. Classification: Grade S1, expected service life over 75 years, per ASTM C 406.
 - 2. Texture: Rough.
 - 3. Standard Thickness: Nominal 5/16 inch.
 - 4. Length: Nominal 18 inches.
 - 5. Width: Nominal 9 inch.
 - 6. Butt Shape: Standard square cut.
 - 7. Color: Unfading mottled green and purple.
- C. Underlayment: Shark Skin Ultra.
- D. Eave Protection Membrane (also at valleys and rake edges): Ice and water shield, self-adhering polymer-modified asphalt sheet complying with ASTM D 1970; nominal total thickness of 40 mils; with strippable release paper and polyethylene sheet top surface.

2.03 FLASHING MATERIALS

- A. Flashing: As specified in Section 07 6200.

2.04 ACCESSORIES

- A. Attachment Members:
 - 1. Material: Pressure preservative treated wood complying with AWPA U1 Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
 - 2. Nailers: Nominal 2 inch wide by 1 inch thick members, or thickness as required for specific conditions.

- B. Nails: Slater's large-headed copper ring shank nails, length not less than twice slate thickness plus 1 inch, or long enough to penetrate completely through roof sheathing.
- C. Plastic Cement: ASTM C 1311 one-part non-sag polymerized butyl sealant.
- D. Sealant: ASTM C 920 low-modulus silicone joint sealer.
- E. Copper Ridge and Hip Accessories: As indicated on drawings, same material as exposed flashings.
- F. See Section 07 7200 - Roof Accessories for snow guards to be installed on slate roofs where indicated in drawings by snow guard manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that roofing accessories and roofing penetrations are complete and properly flashed.
- B. Verify that roof openings are correctly framed.
- C. Verify that roof deck surfaces are dry and free of ridges, warping, and voids.

3.02 PREPARATION

- A. Prepare deck surfaces using methods recommended by the shingle manufacturer for achieving the best roofing results under prevalent project conditions.
- B. Broom clean roof deck thoroughly prior to beginning installation.

3.03 INSTALLATION

- A. Install slate shingle roofing system in accordance with recommendations of shingle manufacturer and in accordance with recommendations of NRCA Steep Roofing Manual (MS104).
- B. Sheet Metal Flashing: Install flashing as indicated and as required by project conditions.
 - 1. Install flashing at all locations where slate roof intersects other roofs, walls, parapets, chimneys, ventilators, and similar projections.
 - 2. Fabricate flashings at open valleys with standing rib at center of valley, not less than 1 inch high; extend flashing not less than 12 inches onto roof deck on each side of valley.
 - 3. Attach shingles at valleys using copper wires to copper straps nailed beyond edge of flashing sheets.
 - 4. Install drip edge flashing at eaves prior to installing underlayment.
 - 5. Install drip edge flashing on downslope roof edges after installation of underlayment.
 - 6. Install metal ridge cap in accordance with NRCA details and recommendations.
- C. Underlayment:
 - 1. Ice and Water Shield Protection: Install eave protection membrane at eaves, valleys, and rake edges, extending to a line that when projected to the horizontal is not less than 24 inches inside of interior wall line.
 - 2. Installation of Synthetic Shark Skin Ultra throughout steep slope roof area. This is to extend over the ice and water shield.
- D. Wood Attachment Members:
 - 1. Nailers: Install nailers at ridge and hips, directly over underlayment. Protect with additional layer of underlayment before installing ridge and hip slates and accessories.
- E. Slate Shingles:
 - 1. Double shingles at eaves and cornice line. Beginning at eaves, project shingles minimum uniform dimension of 2 inches and lay shingles in horizontal courses. Install shingles with minimum of 3-inch headlaps, and stagger joints between courses a minimum of 3 inches. Project shingles minimum uniform dimension of 1.0 inches at gables.
 - 2. Cut and fit shingles neatly around vents, pipes, and other projections.
 - 3. Nail shingles by driving nails to point where nail heads just clear surface of slate, so slates hang on the nails. Do not overdrive nails, putting pressure on underlying slate, and do not underdrive nails, putting strain on overlying slates.

4. Install metal ridge and hip accessories in accordance with manufacturer's details and recommendations.

3.04 PROTECTION

- A. Minimize traffic over the finished roof surface. Where necessary, wear soft-soled shoes and walk on butt of shingles to avoid breakage.
- B. Remove and replace damaged or broken slates before the Date of Substantial Completion.

END OF SECTION 07 3150

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SECTION 07 5401 – EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
1. Adhered EPDM sheet roofing
 2. Polyisocyanurate Insulation
 3. Cover board
 4. Walkway pads
- **The roof removal process will be conducted with an onsite environmental company scanning all materials to determine Radioactive Material. Proper PPE and scanning will impact overall production daily. Materials which have been scanned and determined to be RAD containing materials will be sorted and loaded into a separate RAD containing container provided by others.**
- B. **Scope of Work: Sections A1, A2, A3 & A4:** The scope of work includes the minimizing of the intrusion of dust and debris, created by the process of the installation of the new EPDM Roofing System. The phased installation of the new roof system will be installed in such a manner as to maintain a watertight integrity daily.
1. Perimeter wood nailers must be sufficient in height to match the new insulation assembly thickness.
 2. Curb projections must be sufficient in height to provide a minimum of 8” in flashing height.
 3. Installation of new Roof hatch as identified on drawings.
 4. Installation of wood deck repairs at removed duct penetrations, west dormer structural remediation area followed by chimney removal (total of 3).
 5. Cover re set stone coping into slate tile roof with EPDM membrane. Install 16 oz. copper receiver cap over newly set stone coping as per details.
 6. Installation of designated walk path.
- C. **Roof section A4:** Over the cleaned and prepared wood decking substrate mechanically fasten with FM 105 fastening pattern 5/8” Type X gypsum /Dens deck or equal, prime and install manufactures approved (SA) self-adhered vapor barrier; with FM 1-105 FM ribbon pattern apply the base layer of 1.5” polyisocyanurate insulation followed by the installation of 1/2” HD poly Iso, installation of 1/2” plywood at scuttle hatch roof access followed by the roofing system manufacturer’s 90 mil EPDM membrane shall be installed in order to meet the project’s roofing design guidelines.
- D. **Roof section A3:** Over the cleaned and prepared wood decking substrate mechanically fasten with FM 105 fastening pattern 5/8” Type X gypsum /Dens deck or equal, prime and install manufactures approved (SA) self-adhered vapor barrier; with FM 1-105 FM ribbon pattern apply the base layer of 1.5” polyisocyanurate with 1/8” per foot tapered polyisocyanurate insulation adhered with low rise foam over insulation. Installation of 1/2” HD poly Iso, followed by the roofing system manufacturer’s 90 mil EPDM membrane shall be installed in order to meet the project’s roofing design guidelines.
- E. **Roof sections A1 & A2:** Prime wood deck for the installation of SA Vapor barrier. Installation of 1/4” plywood anchored with approved fasteners in FM 1-105 fastening pattern. Installation of 1/2”-12” tapered panels with low rise foam to create slope to drain throughout.
- F. **ALL Roof sections:** Installation of the roofing system manufacturer’s 90 mil EPDM membrane shall be installed in order to meet the project’s roofing design guidelines. All flashing membranes, prefabricated metal, and sheet metal will be installed in accordance with roofing system manufacturer's recommendations. The installation of butyl caulk or tape at all attachment points of the surface mounted counterflashing. The completed EPDM roof system and

roofing system manufacturer's supplied accessories shall be installed in such a manner so that the roofing system manufacturer's Twenty (20) Year Full Systems (NDL) Warranty can be issued upon successful completion of the roofing project.

1.03 DEFINITIONS

- A. ASTM E108, Class "A".
- B. UL 790, Class "A".

1.04 REFERENCES

- A. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- B. Single-Ply Roofing Institute (SPRI): Application Guidelines and Wind Design Guidelines for Various Single Ply Membranes
- C. National Roofing Contractors Association (NRCA): Current Roofing and Waterproofing Manual
- D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA): Current SMACNA Technical Manuals.
- E. Code of Federal Regulations, (CFR) including:
 - 1. CFR Title 29, Part 1910 "Occupational Safety and Health Standards."
 - 2. CFR Title 29, Part 1926 "Safety and Health Regulations for Construction."
- F. Underwriters Laboratories (UL):
 - 1. Roof Materials and Systems Directory. 2012.
 - 2. UL 790: Tests for Fire Resistance of Roof Covering Materials: 1983.
- G. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) FOR EPDM MEMBRANE:
 - 1. .060" (Black) Non Reinforced
 - 2. ASTM D 412
 - 3. ASTM D 624
 - 4. ASTM D 573

1.05 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing system manufacturer based on testing and field experience.
- C. Roofing System Design: Comply with SPRI "Wind Design Guide for Adhered Single Ply Roofing Systems" for the following ground roughness exposure, classification of building and system design:
 - 1. Surface Roughness Category: Exposure B
 - 2. Classification of Building: Category II
 - 3. Wind uplift Design: 90 mph @ 3 second gust
 - 4. System 1 Design: Adhered Single Ply Membrane Roofing
- D. Underwriters Laboratories Inc. (UL):
 - 1. UL RMSD – 2009 Roofing Materials and Systems Directory
 - 2. UL 790 – 2009 Fire Resistance of Roofing Coverings Materials
 - 3. Exterior Fire Exposure Classification: Class A, ASTM E 108, for application and slopes shown.

1.06 ACTION SUBMITTALS

- A. Product Data: Submit latest edition of roofing system manufacturer's roofing and base flashing specifications including list of materials proposed for use, installation procedures, and roofing system manufacturer's Product Safety Data Sheets.
- B. Product Safety Data Sheets: Installer shall review all product data safety data sheet chemical names prior to submitting to University of Missouri.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of wood plank deck and orientation of membrane roofing.
 - 4. Insulation ribbon methods for corner, perimeter, and field-of-roof locations.
- D. Samples for Verification: Physical samples are not necessary.
 - 1. Sheet roofing, of color specified.
 - 2. Roof insulation.
 - 3. Cover board.
 - 4. Metal termination bars.
 - 5. Battens.
 - 6. Six batten fasteners of each type, length, and finish.
 - 7. Walkway pads or rolls.
 - 8. Safety yellow perimeter tape.

1.07 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified Installer and roofing system manufacturer.
- B. Roofing system manufacturer Certificates: Signed by roofing system manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by roofing system manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.
- E. Single Ply Roofing Institute (SPRI) - Fasteners Withdrawal Resistance Testing:
 - 1. The Installer shall conduct fastener pullout tests in accordance with the August 11, 2011, revision of the ANSI/SPRI FX-1 - American National Standard – Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
 - 2. Prior to starting the project, provide a copy of the Fasteners Withdrawal Resistance Testing to roofing system manufacturer's technical department.
- F. Warranty:
 - 1. Provide sample copy of 20-year (NDL) Full System roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
 - 2. Provide sample of copy 3-year Installer's workmanship warranty stating obligations, remedies, limitations, and exclusions of warranty.
- G. Inspection Report: Copy of roofing system roofing system manufacturer's final inspection report of completed roofing installation.

1.08 CLOSE OUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.09 QUALITY ASSURANCE

- A. Roofing System Manufacturer Qualifications: A qualified roofing system manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications:
 - 1. A qualified firm that is approved, authorized, or licensed by membrane roofing system roofing system manufacturer to install roofing system manufacturer's product and that is eligible to receive roofing system manufacturer's special warranty.
 - 2. Prior to submitting a roofing proposal, Installer must be approval by Owner's representative.
- C. Roofing system manufacturer's membrane shall meet the following characteristics:
 - 1. Protective membrane surface coating to resist accumulation of air borne contaminants such as dust and dirt.
 - 2. Membrane Thickness: Membrane roofing system manufacturer is to verify that the membrane thickness is of the membrane thickness specified ASTM D412 nominal thickness of +/- 10 percent will not be acceptable for measurement of membrane thickness.
- D. Source Limitations: Obtain components including roof insulation, fasteners, and accessories for membrane roofing system from same roofing system manufacturer as membrane roofing.
- E. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings from the applicable testing agency.
- F. Pre-installation Conference: Before installing roofing system, conduct conference at Project site. Notify participants at least 10 working days before the conference.
 - 1. Meet with Owner's Representative/General Contractor, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including roofing system manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.
- G. At no cost to University of Missouri, roofing system manufacturer's technical representative shall perform:
 - 1. Manufacturer's Quality Control Inspection: The Manufacturer's Technical Representative shall review the on-going work on the first day of the roofing production and a minimum of one (1) in-progress inspection every 10 working days. The Roof system manufacturer Technical Representative shall:
 - a. Communicate with the University of Missouri project manager each inspection, i.e. meet with the University of Missouri designated project manager before entering work area.
 - b. Note all defects noted non-compliance with the specifications or the recommendations of the roof system manufacturer should be itemized in a punch list. These items must be corrected immediately by the contractor to the satisfaction of the University of Missouri representative and Roof system manufacturer.
 - c. Ensure the roofing contractor has received a copy of each In-Progress Inspection Report within two days of the inspection. The roofing contractor is to forward the University of Missouri On-site Representative a copy of the In-Progress Inspection Report.
 - 2. Final Roof Inspection: Contractor is to arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of the roofing project.

- a. All defects noted non-compliance with the specifications, or the recommendations of the roof system manufacturer should be itemized in a punch list. These items must be corrected immediately by the contractor to the satisfaction of the University of Missouri and Roof system manufacturer.
- b. The roofing contractor is to forward a copy of Final Inspection Report to the University of Missouri On-site Representative within two days after date inspection(s) is performed.

H. **Installer's Responsibility:** Any failure by the Owner Representative or roofing system manufacturer's Representative to detect, pinpoint, or object to any defect or noncompliance of these specifications of work in progress or completed work shall not relieve the Installer, or reduce, or in any way limit, his responsibility of full performance of work required of the Installer under these specifications.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with roofing system manufacturer's name, product brand name, and type, date of manufacture, and directions for storing and mixing with other components. Deliver materials in sufficient quantity to allow work to proceed without interruption.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Store and protect materials, including roofing insulation from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store all materials in a dry location. Use pallets to support all materials from roof deck. Distribute the load to stay within live load limits of the roof construction. Remove unused materials from the roof at the end of each day's work. Comply with roofing system manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.11 PROJECT CONDITIONS

- A. **Weather Limitations:** Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to roofing system manufacturer's written instructions and warranty requirements.
- B. The EPDM adhered membrane shall not be installed under the following conditions without consulting manufacturer for precautionary steps:
 - 1. The roof assembly permits interior air to pressurize the membrane underside.
 - 2. Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.
 - 3. The wall/deck intersection permits air entry into the wall flashing area.
- C. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.
- D. **Weather Limitations:** Proceed with installation only when existing and forecasted weather conditions permit the roofing system to be installed according to roofing system manufacturer's written instructions and warranty requirements.
- E. **Protection:**
 - 1. Provide special protection and avoid traffic on completed areas of membrane installation.
 - 2. Restore to original condition or replace work or materials damaged during handling of roof materials.
 - 3. Take precautions as required to protect adjacent work and structures.
- F. **Emergency Equipment and Materials:** Maintain onsite equipment and materials necessary to apply emergency temporary edge seal in event of sudden storms or inclement weather. If inclement weather occurs while a temporary water stop is in place, the Installer shall provide the labor necessary to monitor the situation to maintain a watertight condition.

- G. Protection:
1. Arrange work sequence to avoid use of newly constructed Roofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the Installer shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent Roofing areas.
 2. The Installer shall provide a suitable temporary protective surface for all roofing areas which will receive construction traffic or construction equipment during all phases of the roofing project.
 3. During the course of installation of the membrane roofing systems, should there be any damage created by other construction trades to the new or to existing roofing membrane and/or roofing system, the Installer is to immediately notify the Owner's Representative and membrane roofing system manufacturer. All damages are to be repaired according to the membrane roofing system manufacturer's or Owner's representative's recommendations. The "party" responsible for the roofing damage shall bear the total cost for the repairs or for the replacement of the existing or new roofing system.
- H. Restrictions:
1. Comply with Owner's General and Safety Requirements on use of site.
 2. Smoking and Tobacco products are prohibited on all roof areas and on the campus grounds.
 3. Provide and maintain sanitary facilities for employees.
 4. Maintain facility and all utility services in a functional condition.

1.12 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights of the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Installer under requirements of the Contract Documents.
- B. Roofing System Manufacturer's Warranty: Submit a written warranty, without monetary limitation, with all available options, including flashing endorsement, roofing system manufacturer's roof insulation and roofing system manufacturer's accessories, signed by roofing system manufacturer's agreeing to promptly repair leaks resulting from defects in materials or workmanship for the following warranty period:
1. Twenty (20) Year Full System Warranty (no ponding/standing water exclusions accepted). Warranty shall be non-prorated and cover basic wind speeds up to 60 mph.
 2. "Early Bird" warranties are not to be issued, as they will not be accepted by Owner.
 3. The specified roofing system manufacturer's warranty will be issued only upon final acceptance by the roofing system manufacturer's technical department and the Owner's Representative's final approval.
 4. Request for final payment and issuance of the specified Roofing system manufacturer's warranty will be issued to the Installer's after successful completion and Owner's Representative's final approval and acceptance of the entire roof system installation.
- C. Installer's Warranty: Submit roofing Installer's workmanship warranty, on a notarized written warranty form, signed by Installer, covering Work of this Section, including membrane roofing, sheet flashing, cover board, roof insulation, fasteners, adhesives, sealants, and associated sheet metal, for the following warranty period:
1. Warranty Period: Three (3) years from date of Substantial Completion. Refer to University of Missouri Roofing and Sheet Metal Guarantee form in Division 1 near the beginning of this manual.

PART 2 - PRODUCTS

2.01 ROOFING SYSTEM MANUFACTURER

- A. The components of the roof system are to be products of a single roofing system manufacturer or approved by the Roof system manufacturer, whose products meet or exceed the project specifications, have manufactured and installed the roofing materials and systems of the type specified for a minimum of twenty (20) years, and who maintains a single source responsibility for the total roofing system.
- B. Roofing system manufacturers: The components of the roofing system are to be products of a single roofing system manufacturer as required to provide the specified system warranty. Subject to compliance with requirements, provide roofing products from:
1. Versico Incorporated, Akron OH

2. Firestone Roof System, Carmel IN
3. Owner approved manufacturers.

2.02 EPDM MEMBRANE

- A. EPDM Membrane: a uniform, flexible sheet formed from ethylene propylene diene monomer, ASTM D 412, of the following Classification – Type and Grade, Membrane Thickness, UL Classification, and Membrane Exposed Face Color.
1. Classification: Type II, Grade I.
 2. Membrane Thickness: 90 mils, +/- 2.0 mils.
 3. UL Class: A.
 4. Membrane: Exposed Face Color: Black

2.03 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing materials.
1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdictions.
- B. Membrane flashing and Flashing Accessories: As recommended by the roofing system manufacturer's printed instructions for sheet flashing of same material, mil thickness and color as sheet membrane.
- C. Asphalt Resistance Membrane Flashing: Roof system manufacturer's SA vapor barrier. The asphalt resistance membrane flashing can be adhered directly to asphalt-contaminated surfaces. The asphalt resistant membrane can be installed over the field membrane to act as a protection layer membrane in conditions where oil and grease could develop from roof-top equipment.
- D. Insulation Fasteners: Roofing system manufacturer approved corrosion resistant steel #12 "fasteners," screws of the appropriate size and type for roof membrane and insulation attachment. A #12 corrosion-resistant fastener is used with plates to attach insulation boards to steel roof decks. Fasteners for the insulation shall be supplied and installed as recommended by the roofing system manufacturer's printed instructions.
- E. Insulation Securement Plates: Roofing system manufacturer approved corrosion resistant steel, 3 inch round plates, "plates," of the appropriate size and type for the securement of the insulation to approved substrates. Securement plates for the insulation shall be supplied and installed as recommended by the roofing system manufacturer's printed instructions.
- F. Membrane Securement Plates: Roofing system manufacturer approved corrosion resistant steel, 2 inch round plates, "discs," for the securement of the membrane to the steel roof decks. Securement plates for the membrane shall be supplied and installed as recommended by the roofing system manufacturer's printed instructions.
- G. Membrane Securement Screw: Roofing system manufacturer approved corrosion resistant steel, "#15 screws" of the appropriate size and type for roof membrane securement. A #15, heavy-duty, corrosion-resistant fastener used with "discs" and "termination bar" to attach Roof system manufacturer's roof membrane to steel roof decks. Fasteners for the membrane shall be supplied and installed as recommended by the roofing system manufacturer's printed instructions.
- H. Membrane Bonding Adhesive: Roofing system manufacturer's approved contact adhesive, Standard bonding adhesive, used to attach membrane to the horizontal or near-horizontal substrate. Application rates are to be as recommended by the roofing system manufacturer's printed instructions.
- I. Membrane Flashing Bonding Adhesive: Roofing system manufacturer's approved contact adhesive, used to attach the flashing membrane to the substrate, either horizontally or vertically. Application rates are to be as recommended by the roofing system manufacturer's printed instructions.
- J. Metal Termination Bar: a heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Reglet is produced from 6063-T5, 0.10 inch to 0.12 inch (2.5 mm to 3.0 mm) thick extruded aluminum. "reglet" has a 2-1/4 inch (57 mm) deep profile and is provided in 10 foot (3 m) lengths.

- K. Membrane Securement Bar: is a 1 inch wide aluminum alloy bar used with to clamp the membrane to the roof deck along walls, curbs, and certain vertical to horizontal changes in the roofing system. Termination bar is supplied in bundles of 25 pieces. Each termination bar is 10 feet long.
- L. Sealants: Owner approved sealant shall be used to seal penetrations through the membrane system and at miscellaneous sealant applications that are exposed to roof systems components.
- M. Safety Warning Membrane: A highly visible product to draw attention to unprotected roof perimeters and potentially hazardous area. The safety warning membrane is designed for use on a membrane roof. The EPDM safety warning membrane shall be yellow in color, 60 mils in thickness, 4 inches wide, and 100 feet in length.
- N. Pre-Fabricated Pipe Flashing: prefabricated vent pipe flashing made from 0.060 inch (60 mil/1.5 mm) thick membrane.
- O. Pre-Fabricated Corner Flashing: prefabricated universals corners made of 0.060 inch (60 mil/1.5 mm) thick membrane that are adhered/quick applied to membrane base flashings.
- P. Aluminum: ASTM B 209-86, alloy and temper - 3003-H14, 0.040 inch thick aluminum sheet, mill finish with formed drip edge.
- Q. Mineral Wool-Fiber Fire-Resistant Insulation: Semi-rigid mineral-wool-fiber batt insulation; Type IVA per ASTM C 612; not less than 144 psf (6.9 kPa) compressive strength per ASTM C 165; less than 0.05 percent moisture absorption per ASTM C 1104; complying with ASTM E 136; and with the following surface-burning characteristics per ASTM E 84:
 - 1. Flame Spread: 0.
 - 2. Smoke Developed: 0
 - 3. Manufacturers: Subject to compliance with requirements, available products include the following:
 - a. Basis of Design: Roxul Safe; Roxul Inc.
- R. Other miscellaneous materials shall be of the “best grade” available and to be approved in writing by the roofing system manufacturer for the specific application.

2.04 INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements, selected from roofing system manufacturer’s standard sizes and of thickness indicated.
- B. Polyisocyanurate board insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM 1289-03, Type 2, Class 1, Grade 2
- C. Insulation Requirements:
 - 1. **Roof design 1:** Install one layer of 5/8” gypsum board, mechanically attached to wood plank deck. Adhered SA vapor barrier to gypsum board. Install 1.5” base layer poly Iso adhered with low rise foam to self-adhered vapor barrier. Install ½” HD polyisocyanurate board, adhered with low rise foam adhesive.
 - 2. **Roof design 2:** Install one layer of 5/8” gypsum board, mechanically attached to wood plank deck. Adhered SA vapor barrier to gypsum board. Install 1.5” base layer poly Iso followed by ¼” in 12” tapered poly iso adhered with low rise foam. Install ½” HD polyisocyanurate board, adhered with low rise foam adhesive.

2.05 COVER BOARD

- A. High density polyisocyanurate cover board: Closed cell polyisocyanurate foam with coated glass matt facer laminated to both faces, complying with the following additional characteristics:
 - 1. Thickness: 1/2 inches.
 - 2. Size: 48 inches by 48 inches, nominal.
 - 3. R-Value (LTTR):
 - a. 0.5 inches, R-Value: 2.5, minimum.
 - 4. Compressive Strength: 100 psi.

5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
6. Recycled Content: 8.3 percent post-industrial, average.

- B. Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing materials.
1. Type, Thickness and Size: Gypsum core board with a thickness of ½ -inch x 4 feet x 8 feet.
 2. UL Class A (UL 790) and ULC S-102
 3. Product: Subject to compliance with requirements, provide product as manufactured by:
 - a. “Dens-Deck Prime[®]” as manufactured by Georgia-Pacific Corporation.

2.06 INSULATION AND COVER BOARD ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation roofing system manufacturer for intended use and compatible with membrane material.

2.07 DUAL COMPONENT POLYURETHANE ADHESIVE

- A. General: Provide a dual component polyurethane adhesive that is intended for the attachment of polyisocyanurate insulation to various substrates. The dual component polyurethane adhesive must have approvals from the insulation and roofing system manufacturer for adhering the polyisocyanurate insulation to approved substrates, multiple layers of polyisocyanurate insulation, and cover boards. Consult adhesive roofing system manufacturer on current acceptable substrates to apply dual component polyurethane adhesive to various substrates.
- B. Dual component polyurethane adhesive: The low-slope dual component polyurethane adhesive shall have the following minimum properties:
1. Density ASTM D-1622: Free Rise, 3.2 lb./cf.
 2. Compressive Strength ASTM D-1621: Parallel, 38 psi @ 6% deflection
 3. Tensile Strength ASTM D-1623: 35 psi
 4. Water Absorption ASTM D-2843: 5.1%
 5. Closed Cell Content ASTM D-6226: 90% min.
 6. R-Value ASTM C-518 3.8/inch (new)
 7. VOC Content ASTM D-2369 <5 g/l (1&2 combined)
 8. Weight/Gallon: Part A Component 10.32 lbs. Part B Component 8.54 lbs.
- C. Approved Roofing system manufacturer and Product:
1. OMG Roofing Products, “OlyBond 500[®] SpotShot.”
 2. Roof system manufacturer, “OM Board Adhesive.”
 3. Approved equal as approved by Owner or Roof Consultant

2.08 VAPOR RETARDER

- A. Self-Adhered (SA) - 32 mil (0.8 mm) self-adhesive vapor barrier that can also serve as temporary roof protection. Self-Adhered is available in rolls 44.9 inches x 133.8 feet (1.14 x 40.8 m).
- B. SA Primer - A polymer emulsion water based primer designed to improve the adhesion of SA vapor retarder on concrete and METAL roof decks or plywood walls. Application temperature must be 41°F (5°C) and above. The coverage rate will range from 163 - 400 ft²/gal (4 - 9.8 m²/L) for non-porous surfaces to 82 - 135 ft²/gal (2 - 3.3 m²/L) for porous surfaces. The VOC content is 3 g/L.

2.09 RELATED MATERILAS

- A. Timber, General: Hand select material at factory from lumber of species and grade indicated below for compliance with "Appearance" grade requirements of ALSC National Grading Rule; provide certificate of inspection from an accredited Agency for selected material.
1. Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2-inches or less in thickness.

2. Provide lumber with 15 percent moisture content at time of dressing and shipment for, sizes 2-inches or more in thickness.
- B. Dimensioned Lumber: Graded in accordance with established grading rules; grade and species as follows:
1. Concealed Boards: WWPA standard grade, any species, or SPIB No. 3 grade Southern Pine.
 2. Lumber for Miscellaneous Uses: Standard grade unless otherwise indicated.
 3. Plywood: PS 1; select sheathing grade or APA rated 5/8-inch minimum thickness, CD-X, or better in sheathing.

2.10 MISCELLANEOUS FASTENERS AND ANCHORS

- A. General: All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum, or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1¼ inch (32 mm) and shall be approved for such use by the fastener roofing system manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch (25 mm), stainless steel, and to be approved for such use by the fastener roofing system manufacturer.

2.11 PROTECTION PADS

- A. Protection Pads: “- factory-formed, nonporous, heavy-duty, slip resisting, surface-textured protection pads, as supplied Roof system manufacturer. The color of protection pads shall be black. Protection pads to be used under all wood support blocking, equipment supports, pipe steel supports, and under downspout splash blocking.

2.12 ROOF WALKWAYS

- A. Walkway: factory-formed, nonporous, heavy-duty, slip resisting, surface-textured protection pads, approximately 2” thick, as supplied Roof system manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect entire roof area to be roofed for acceptability. Examine substrates, areas, and conditions for compliance with the following requirements and other conditions affecting installation and performance of the roofing system:
- a. Verify that roof openings and penetrations are in place, and curbs are set and braced, and that the roof drains and drain lines are properly clamped into position and are in a 100% functional condition.
 - b. Verify that primary drain bodies are at proper elevations for construction of sump at slopes indicated.
 - c. Verify that secondary overflow drain bodies are at proper elevations for construction, without sumps, at level of roof surface.
- B. The Installer shall conduct fastener pullout tests in accordance with the August 11, 2011, revision of the ANSI/SPRI FX-1 - American National Standard – Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. Verify that structural use panels, sheathing, and similar wood products are securely anchored to substrates, and that surfaces of panels and sheathing are without irregularities which could interfere with proper membrane and flashing installation.
- D. Visually inspect wood plank roof deck for the following:
1. Evidence of impaired deck structural capacity or integrity.
 2. Ridges or uneven conditions.
 3. Holes, voids, or gaps in wood planks.
 4. Accumulations of moisture.
- E. Other conditions that would prevent proper application of roofing or that would prevent membrane roofing manufacturer's approval of substrate, components, or system.

- F. Verify that roofing systems can be installed with positive drainage of minimum slopes indicated at all areas of roof, without ponding after 24 hours.
- G. Verify that roofing as completed will discharge adequately without ponding or inadvertent discharge through wall scuppers.
- H. Verify that final installed curb heights for flashing are a minimum of 8-inches (200 mm) measured above finished roof membrane.
- I. Verify piping and conduit penetrations of roof are made individually, separated by a minimum of 12 inches (300 mm) from each other and from restraining surfaces or other obstructions.
- J. Verify locations of interior electrical conduits, piping, ducts, and similar items near underside of steel roof decking, to avoid striking with fasteners.
- K. Verify that the deck and other substrates are dry, free of debris, excess, and foreign materials.
- L. Verify substrates and surfaces to receive flashings are dry, clean, and free of sharp or penetrating projections or other irregularities.
- M. Proceeding: Proceed with installation only after unsatisfactory conditions have been corrected.
- N. Do not commence work until decking and substrates are in full compliance with roof system manufacturer's requirements, deck and substrate conditions are sound, and positive fall to drainage points are achieved.
- O. Commencement: Commencement of work indicates acceptance of conditions and responsibility for all corrections.

3.02 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove all sharp projections.
- B. The Installer will be entirely responsible for the complete removal of all dirt, debris, and moisture from the roof's substrate, before the installation of the roofing system. The roof's substrate must be 100% completely dry before applying the spray-in-foam insulation or before the installation of the specified roofing insulation.
- C. Cleaning: Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- D. Cleaning, repair or replacement of damaged items, as a result of roofing related materials entering the facility, shall be solely at the roofing contractor's expense.
- E. Broom clean cover board immediately prior to membrane roofing application.
- F. Promptly remove debris each day; do not stockpile debris or allow waste to accumulate on steel decking, insulation, or roofing under construction.
- G. Containment: Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction at the end of the workday or when rain is forecast. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- H. Mask off adjoining surfaces not receiving roofing membrane materials to prevent spillage or over spray affecting other construction.
- I. Fill all gaps and voids between substrate components that are wider than 1/4 inch. Fill all gaps with the same materials as the substrate.

- J. Seal around along perimeters, along equipment curbs, around pipes, around conduits, and any other roof penetrations with vapor barrier.
- K. Base Vertical Flashings: Coordinate roof insulation thickness with adjacent base flashing height, to maintain not less than 8-inch (203 mm) flashing height. Adjust base vertical flashing height including substrates and changes in exterior wall materials to maintain minimum height.
- L. Proceed with roofing work only when weather conditions permit work to proceed in accordance with manufacturer's requirements and recommendations.

3.03 WOOD NAILER INSTALLATION(Included in base bid)

- A. All Wood Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons/lineal meter) in any direction. Individual nailer lengths shall not be less than 3 feet (0.9 meter) long. Nailer fastener spacing shall be at 12 inches (0.3 m) on center or 16 inches (0.4 m) on center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches (0.15 m) of each end. Two fasteners shall be installed at ends of nailer lengths. Wood nailer attachment shall meet the current Factory Mutual Loss Prevention Data Sheet 1-49. Refer to Division 06 1000 for acceptable fasteners for wood product attachments.
- B. Wood Nailer thickness shall be as required to match the insulation and cover board height (thickness) to allow a smooth transition.
- C. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any roof system manufacturer product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.
- D. New wood nailers and/or plywood sheeting shall meet the performance criteria in Division 06 1000.

3.04 VAPOR-RETARDER / AIR BARRIER INSTALLATION

- A. Install Self-Adhered over a SA Primer. Do not install when it is raining, snowing, or on wet/humid surfaces. Install in temperatures 32°F (0°C) and above. The use of a primer is required on the following substrates: wood, concrete, lightweight concrete, gypsum boards and decks, and DensDeck Prime® boards.
- B. Begin application at the bottom of the slope. Unroll Self-Adhered onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 in. (75 mm) lengthwise following the reference line and by 6 in. (150 mm) at each end. Stagger end laps by at least 12 in. (300 mm). Tool vapor barrier up all penetrations and or perimeters and seal. Vapor barrier to be installed as if the VB was a temp roof. Do not immediately remove the silicone release sheet.
- C. Once aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold Self- Adhered tight and peel back the release sheet by pulling diagonally.
- D. Use a 75 lb. (34 kg) roller to press Self-Adhered down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.05 INSULATION BOARD INSTALLATION

- A. General Criteria:
 - 1. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
 - 2. Wet, broken, warped, or bent insulation boards are not acceptable. Any damaged insulation boards are to be replaced with new insulation boards.
 - 3. The substrate surface must be free of debris, dirt, grease, oil, ice, snow, frost, standing water, and must be 100% completely dry prior to the installation of the specified roofing insulation or during the time of applying the dual component polyurethane adhesive.

4. Construct sumps at primary roof scuppers using tapered insulation to slope indicated. Install nailers or blocking as required to secure drain body assembly to roof deck.
 - a. Unless otherwise indicated, construct sumps to consistent and uniform slope of 1/4 per 12 inches (1:48) to provide a smooth transition from the roof surface to the drain. Do not introduce steeper or shallower slopes within sump.
 - b. Use tapered insulation to form a square sump. Unless indicated otherwise, construct sump measuring 4 foot by 4 foot at primary roof drains.**
 - c. Adjust primary roof scupper assemblies to proper elevation for sump.
 - d. Install tapered insulation so edges do not restrict flow of water.
 - e. Do not create circular depressions around primary roof drains at bottoms of sumps.
 5. Where conditions require drain modifications to match specified insulation thickness, roofing contractor will be responsible for the cost of readjusting the primary roof drain bowl and associated plumbing to match the “finished” insulation thickness. University of Missouri will not permit circular depressions, nor the cutting or shaving the insulation in order to slope the insulation to the edge of the drain bowl.
 6. University of Missouri will not permit loose boards under foot. Contractor is expected to use adequate weight during the application of the insulation boards. Boards in excess of 1/8” deflection will not be permitted.
 7. Roofing system manufacturer’s technical representative shall be on the jobsite during the first initial day of installation of the roofing system.
- B. Installation of additional “flat stock” and tapered polyisocyanurate insulation:
1. The “flat stock” and / or tapered polyisocyanurate insulation panels shall be laid transverse to the proceeding layer of insulation, with joints staggered at least 1/3 of overall length from those of the proceeding layer of the “flat stock” insulation.
 2. The “flat stock” and / or tapered polyisocyanurate insulation boards shall be adhered to top layer of “flat stock” insulation with the dual component polyurethane adhesive. The dual component polyurethane adhesive shall be dispensed ¾ inch wide and 12 inches on center bands in the field of the roof. In the corners and perimeters of the roof area where the tapered crickets or saddles are to be installed, the number of ribbons per unit width or area over the field rate by:
 - a. 70% in the perimeter - resulting in a maximum on center spacing equal to 60% of the field spacing (field ribbons at 12" on center, the perimeter spacing shall be 7" on center).
 - b. 160% in the corner - resulting in a maximum on center spacing equal to 40% of the field spacing (field ribbons at 12" on center, the corner spacing shall be 4.8" on center.).
 3. After allowing dual component polyurethane adhesive to rise ¾ inch to 1 inch, lay insulation board in to position and walk into place. After walking into place, the insulation board shall be pressed firmly into the adhesive layer using an approved weighted roller by frequent rolling in two or more directions. Contractor shall also “weight down” the insulation board to ensure proper adhesive to the top layer of insulation.
 4. University of Missouri will not accept any un-adhered or loose insulation boards. After installation of the insulation board, if the insulation board is not properly adhered to the proceeding layer, the Installer will be held responsible for replacing the unacceptable installed insulation board. All cost related, i.e. replacement of specified insulation, cover board, membrane, etc., to the replacement of the unacceptable installed insulation board will be at no cost to the Owner.

3.06 COVER BOARD INSTALLATION

- A. General Criteria:
1. Fasten the specified cover board according to requirements of the roofing system manufacturer’s written instructions.
 2. Wet, broken, warped, or bent insulation boards are not acceptable. Any damaged cover boards are to be replaced with new cover boards.
 3. Consult roofing system manufacturer on current acceptable substrates and rates for applying the low-rise urethane adhesives. The surface of substrate shall be inspected prior to installation of the cover board.
 4. The substrate surface must be free of debris, dirt, grease, oil, ice, snow, frost, standing water, and must be 100% completely dry prior to the installation of the specified cover board or during the time of applying the dual component polyurethane adhesive and the spray- in-place foam.
 5. Roofing system manufacturer’s technical representative must be on the jobsite during the first initial day of installation of the roofing system.
 6. Install a single layer of cover board over the specified polyisocyanurate insulation.

7. The cover board sheeting shall be laid transverse to the top layer of the insulation board, with joints staggered at least 1/3 of overall length from those of the insulation layer.
8. The cover board shall be neatly cut to fit within 1/4 inch (6 mm) of nailers, penetrations, and projections.
9. Fill all gaps exceeding 1/4 inch (6 mm) with spray-in-place foam insulation.
10. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
11. Do not install more cover board than can be covered with the specified roofing system by the end of the day, or onset of inclement weather.

B. Attachment of Cover Board:

1. Apply the dual component polyurethane adhesive at the manufacturer's written instructions for adhering the specified cover board to the specified polyisocyanurate insulation.
2. The dual component polyurethane adhesive shall be dispensed in 12 inches on center bands in the field of the roof. In the corners and perimeters of the roof area, the number of ribbons per unit width or area over the field rate by:
 - a. **70% in the perimeter - resulting in a maximum on center spacing equal to 60% of the field spacing (field ribbons at 12" on center, the perimeter spacing shall be 7" on center).**
 - b. **160% in the corner - resulting in a maximum on center spacing equal to 40% of the field spacing (field ribbons at 12" on center, the corner spacing shall be 4.8" on center).**
3. After allowing low rise urethane foam to rise ¾ inch to 1 inch, lay cover board in to position and walk into place. After walking into place, the cover board shall be pressed firmly into the adhesive layer using an approved weighted roller by frequent rolling in two or more directions. Contractor shall also use "weights" to ensure the cover board is completely adhered to the top layer of the polyisocyanurate insulation. There shall not be any elevation change or raise of the corners or sides of the cover board as compared to the sides of the adjacent cover board sides. The cover board shall lay flat or level as compared to the edges of the adjacent cover board.
4. **After installation of the cover board, should the cover board have more than 1/8 inch deviation or rise to the adjacent cover board, the Installer will held responsible for replacing the unacceptable installed cover board. All cost related, i.e. replacement of specified insulation, cover board, membrane, etc., to the replacement of the unacceptable installed cover board will be at no cost to the Owner. The replacement of the unacceptable cover boards shall be completed prior to the installation of the membrane.**

3.07 ADHERED EPDM ROOFING MEMBRANE INSTALLATION

- A. Install EPDM sheet over area to receive roofing according to roofing system manufacturer's written instructions. Adhere membrane on all roof areas using largest sheet practical for job conditions. Avoid wrinkling or stretching the membrane. Unroll sheet and allow relaxing for a minimum of 30 minutes.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically fasten roofing membrane securely at terminations, penetrations, angle changes and perimeter of roofing.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing membrane, tape side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 1. Test lap edges to verify seam strength.
 2. Apply lap sealant to seal all edges of flashing membrane and T-Patches.
 3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- I. **USE CAUTION TO ENSURE ADHESIVE FUMES ARE NOT DRAWN INTO THE BUILDING.**
- J. Mechanically fasten membrane securely at all vertical to horizontal transitions, at points of terminations, and at the perimeter of roof in order to meet Manufacturer's Technical Department's requirements for properly securing the specified roofing system.
- K. Spread sealant bed over deck drain flange at deck drains and securely seal roofing membrane in place with drain clamping ring.
- L. Securement Around Perimeter and Rooftop Penetrations
 1. Around all perimeters, at the base of walls, drains, curbs, vent pipes, or any other roof penetrations, roofing system manufacturer's fasteners and termination bar or discs shall be installed. Fasteners, disc, and termination bar shall be installed according to the roofing system manufacturer's instructions. Fasteners shall be installed using the fastener roofing system manufacturer's recommended fastening tools with depth locators.
 2. EPDM membrane flashings shall extend a minimum of 3 inches past the securement bar or plates and shall be adhered onto the EPDM membrane.
- M. Field-seam according to Section 3.07, "Seam Installation."
- N. Excessive Repairs: Excessive repairs to membrane, or to membrane seams are not permitted. Remove and replace membrane in entire area affected, and as directed by University of Missouri representative.

Note:

1. **The Installer shall employ all means necessary to assure that the installation of all field and flashing membranes are free of loose (un-adhered) areas and wrinkles. The Owner's Representative(s) reserves the right to require that all preventable loose and /or wrinkled field membrane and membrane flashings to be repaired to the satisfaction of the Owner's Representative. In the event that the Installer determines that loose and /or wrinkled membrane or membrane flashing is unavoidable in a specific area(s), the onsite Owner's Representative must be notified immediately for a determination of acceptability.**
2. **Contractor is to ensure during the time of installing the membrane field and membrane flashing sheet, there are no entrapment of debris under the membrane.**

3.08 MEMBRANE FLASHING INSTALLATION

- A. General: All membrane flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the roofing system manufacturer. Approval shall only be for specific locations on specific dates. Membrane flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces.
- B. Manufacturers required adhesive to be used to adhere the EPDM membrane flashing to acceptable wall and equipment curb substrates. No bitumen shall be in contact with the EPDM membrane. If bitumen exists **install Cav Grip primer or equal over existing bitumen.**
- C. Manufacturers Adhesive for Membrane Flashings:
 1. Over the properly installed and prepared flashing substrate, the adhesive shall be applied according to instructions found on the Product Data Sheet. The adhesive shall be applied in smooth, even coats with no gaps, globs, or similar inconsistencies. Only an area that can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.
 2. No adhesive shall be applied in seam areas that are to be adhered. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by techniques.
 3. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and corners applied. Where applicable, roofing system manufacturer's pre-fabricated corners shall be used.
 4. The membrane flashing shall be completely adhered to the substrate with no unadhered areas.

- D. All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level unless otherwise accepted in writing by the Owner's Representative and roofing system manufacturer's technical department.
- E. Vertical Surfaces Taller than 24 Inches (760 mm): Where vertical distance of flashing membrane exceeds 24 inches in height, in addition to terminations at base flashings, mechanically fasten fully adhered flashing membrane with additional termination bar installed horizontally at not greater than 30 inches (760 mm) on center vertically to top of flashing membrane.
1. Install membrane cover strip of standard sheet at last 8 inch (0.23 m) in width of same material, type, reinforcement.
 2. Install baton bar and cover strip using mechanical fasteners as roofing progresses. Do not proceed with roofing without full attachment of termination bars and installation of coversheet for area under construction.
- F. Flashing Termination: Terminate all vertical flashing membrane surfaces horizontally and vertically with mechanically fastened termination bars and sheet metal flashings/counterflashings. Mechanically fasten flashing membrane securely using mechanical fasteners specifically designed and sized for fastening specified membrane flashing and termination bars into substrate.
1. Fasten batten bar/termination bar with fasteners not greater than 6 inches (152 mm) on center for length of bar, with fasteners within 3 inches (76 mm) of ends, or closer as required by manufacturer. Fasten into nailer or other substantial backing located behind point of base or curb termination.
 2. Uniformly fasten, seat, and compress termination bar into top of fully adhered flashing membrane.
 3. Install sealants continuously across surface of termination, including terminations covered with sheet metal flashing and counterflashing.
 4. Install termination bars using mechanical fasteners as roofing progresses. Do not proceed with roofing without full attachment of termination bars for area under construction.
 5. At termination of vertical and wall sheet flashings not under copings, install termination bar at vertical and wall membrane flashings with metal surface mounted one- or two- piece counterflashing assemblies, as is required for condition. Install as indicated in Drawings, or if not shown in Drawings or otherwise indicated, as required to produce continuous closure of membrane with termination bar and metal flashing, regardless of abutting materials overlap.
 6. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for requirements for counterflashings and other metal fabrications.
- G. Primary Roof Scuppers: Install membrane into sump and extend into line of depressed sump at roof drain. Install membrane free of wrinkles or surface irregularities. Shingle seams around and outside sump in direction of water flow and drainage; backwater laps and seams are not permitted in or around sumps or drains.
1. Cut membrane to fit roof scupper piping inlet; do not allow membrane to restrict opening size.
 2. Spread sealant over roof drain deck flange and securely seal roofing membrane in place with clamping ring. Seal between membrane and scupper base with water cut off mastic in accordance with manufacturer's recommendations.
 - a. Apply sealant in strict compliance with manufacturer's requirements.
 3. Install membrane to comply with other requirements indicated for roofing membrane.
 4. Remove and replace any steel fasteners and washers in clamping ring. Install clamping ring using stainless steel fasteners and washers.
 5. Securely tighten clamping rings to provide constant pressure on water cut off mastic.
 6. Install new metal strainers to complete primary roof drains.
- H. High- or Elevated- Temperature Vent Flashings: Install prefabricated or field-formed membrane flashings to comply with manufacturer's written requirements and recommendations and as indicated. Field form flashings from sheet flashing membrane designed for and suited to condition.
1. Install stainless steel metal base fabricated metal flashing sleeves prior to installing flashings.
 2. Install fire-resistant mineral-wool-fiber insulation between metal flashing sleeve and high- or elevated-temperature outside vent surfaces.
 3. Select proper diameter prefabricated flashing to properly fit penetration and roof conditions.
 4. Secure deck membrane around metal base sleeve penetration to comply with manufacturer's requirements. Secure close to penetration so prefabricated flashing will cover attachments. Secure top of membrane flashing to top of sleeve penetration.
 5. Secure deck membrane around sleeve penetration to comply with manufacturer's requirements. Secure close to penetration so prefabricated flashing will cover attachments.

6. Install flashings to produce a minimum of 8-inch (200 mm) flashing height.
 7. Lap base of flashings atop roof membrane at least 4 inches (100 mm). Hot-air seams at roofing membrane lap.
 8. Place prefabricated flashing in place tight to horizontal deck membrane; ensure flange lays flat to deck membrane.
 9. base of prefabricated flashing continuously to deck membrane.
 10. Where required by manufacturer, heat upper part of prefabricated flashing to temperature required by manufacturer; avoid overheating.
 11. Clamp top of flashing at vent with stainless steel clamping ring.
 12. Install stainless steel metal umbrella cap flashing, holding close to membrane base flashing.
- I. Only an area, which can be completely covered in the same day's operations, shall be flashed.
- J. Daily test lap edges with probe to verify seam continuity of all membrane flashings.
- K. Complete all membrane flashing and metal details on a daily basis. No temporary flashings shall be allowed with the prior written approval of the Owner's Representative and roofing system manufacturer. If any water is allowed to enter under the completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Installer's expense.
- L. **USE CAUTION TO ENSURE ADHESIVE FUMES ARE NOT DRAWN INTO THE BUILDING.**
- M. Installer is to ensure there are no wrinkles and "fish-mouths" in the membrane flashing and in the overlap seams.
- N. Excessive Repairs: Excessive repairs to seams or flashings are not permitted. Remove and replace membrane, and if required the roofing components, in entire area affected as directed by University of Missouri representative.

3.09 PERIMETER AND METAL BASE FLASHINGS

- A. General: All flashings shall be installed concurrently with the roofing membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the roofing system manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Installer's expense.
- B. Sheet metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- C. All Copper perimeter metal edging shall be fabricated and installed per current SMACNA requirements.
- D. Secure the copper metal over the field membrane and the "Multi-Purpose Sealing Tape." Fastened the sheet metal with approved copper nails or another acceptable fastener. Fasteners shall be fastened 4 inches on center and staggered 4 inches on center.
- E. An 8 inch minimum wide strip of the 90 mil membrane flashing shall be adhered to the 4 inch wide flange of the sheet metal and to the field membrane. Check all coverstrip with a rounded screwdriver. Re-work any inconsistencies.

3.10 WALKWAY INSTALLATION

- A. Installer is to install walkway in the areas as indicated on roof plans. Installer is responsible for verification of the total linear footage of the required walkway installation. The minimum length of the walkway, installed at any one location, shall be four (4') feet.
- B. Install the walkway to roofing system manufacturer's written instructions.
1. Clean all dirt and debris from the deck membrane in areas where the walkway will be installed.
 2. Important: Check all deck membrane s with a rounded screwdriver prior to installation of walkway. Re-adhere any inconsistencies before walkway installation.

3. Install walkway in the indicated roof areas.
4. Installer should adhere the walkway to the field membrane.

3.11 PROTECTION PAD INSTALLATION

- A. General: Install protection pad under exposed wood blocking and under equipment supports.
- B. The installation of the protection pad:
 1. Clean all dirt and debris from the deck membrane in areas where the protection pad will be installed.
 2. Important: In areas where protection pads are to be installed, Installer is to probe all field membrane seams laps with a rounded screwdriver prior to installation of the protection pad. Re-adhere any inconsistencies before protection pad installation.
 3. Cut the protection pad 4 inches (4") wider than the dimensions of the wood blocking or equipment and piping support.
 4. Adhere the entire perimeters of the protection pad to the field membrane sheet.
 5. Probe all protection pad seams with a rounded screwdriver. Re-adhere any inconsistencies found in the protection pad seams.
 6. Center the wood blocking or equipment or pipe support over the protection pad.

3.12 HIGHLY VISIBLE MEMBRANE INSTALLATION

- A. General Requirements: Provide and install a highly visible membrane product; designed to draw attention to unprotected roof perimeters and potentially hazardous areas that do not comply with University of Missouri safety guidelines.
- B. Installation of yellow, 4 inch wide, cover strip:
 1. Installer and University of Missouri Representative shall verify unprotected roof perimeters and potentially hazardous areas on the referenced project's roof area(s).
 2. The yellow cover strip shall be installed not less than 6 feet 6 inches (2 meters) from unprotected roof perimeters and potentially hazardous areas.
 3. Before installing the yellow membrane 4 inch wide cover strip, the Installer shall have Roof system manufacturer Technical Representative to verify permanence of all deck membrane with a rounded screwdriver. Repair any inconsistencies of the membrane seams before yellow membrane installation.
 4. The roofing membrane shall be properly cleaned prior to install the "yellow membrane 4 inch wide cover strip." Failure to properly clean the membrane will result in less than satisfactory adhesion of the yellow membrane.
 5. Peel and stick the yellow cover strip to the installed and inspected roofing membrane.
 6. Installer shall take care to avoid trapping air under the yellow membrane.
 7. After adhering the yellow cover strip, the Installer shall verify permanence of all yellow cover strip. Repair any inconsistencies of the yellow cover strip installation.

3.13 TEMPORARY ROOFING TERMINATIONS AND PROTECTION

- A. Prior to starting roofing project, the Installer shall inspect the facility existing roof area(s) associated with the contract roofing project for any defects which could cause water or moisture vapor entries into the building during the roofing application. Any defects or concerns shall be addressed in writing to the Owner's representative prior to starting the roofing project. Proceeding with the roofing project indicates the Installer's acceptance of the existing facility conditions.
- B. For existing roof areas where access is absolutely required for the installation of the new roofing system on another roof area, the Installer shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent roof areas. A suitable temporary protective surface shall be provided for all roof areas which receive traffic during construction of the new roofing system. During the roofing project, any damage which occurs to the new or existing roofing membrane and/or system shall be removed and replaced at the Installer's expense.
- C. The Installer shall provide the labor and materials required to maintain a watertight and impermeable condition at all times on the roof areas as referenced in the project's contract documents. All membrane and metal flashings shall be installed concurrently with the field membrane installation to maintain a 100% watertight and to prevent any air/water vapor infiltration into the completed roofing system each day.

- D. When an interruption or a postponement in the roofing work occurs during the installation of the roofing system, the Installer shall install temporary watertight and hermetic terminations across the installed Roof system manufacturer roofing system. The Roof system manufacturer roofing system shall be 100% impermeable to prevent water and air/water vapor infiltration into or under the new roofing system. When work resumes, any contaminated membrane shall be removed from the work area and disposed off site. None of these materials shall be reused in the new work.
- E. During inclement weather or during a postponement in the roofing work occurs while a temporary water stops or terminations are in place, the Installer shall provide the labor and materials to monitor and ensure the temporary water stops and terminations are 100% watertight and impermeable condition.
- F. If any weather related moisture or the result of moisture caused by the condensation of water vapor are allowed to enter into the newly-completed Roof system manufacturer Roofing System, the affected roof area(s) shall be removed and replaced at the Installer's expense.

3.14 FIELD QUALITY CONTROL

- A. Quality Control of Seams:
 - 1. The Installer shall designate a Quality Control Supervisor to daily check all seams for continuity by using a rounded screwdriver.
 - 2. On-site evaluation of completed seams shall be made by the Installer at locations as directed by the Owner's Representative or roofing system manufacturer's technical representative.
 - 3. All membrane seams, both field and flashings, shall be adhered to and probed on a daily basis. NO EXCEPTIONS.
- B. Roofing system manufacturer's technical representative: Installer shall arrange to have the system manufacturer's technical representative on site for the first day of installation of the roofing system. The Technical Representative shall note:
 - 1. Conduct a site inspection on the first day of production.
 - b. Communicate with the University of Missouri project manager each inspection, i.e. meet with the University of Missouri designated project manager before entering work area.
 - c. Note all defects noted non-compliance with the specifications or the recommendations of the roof system manufacturer should be itemized in a punch list. These items must be corrected immediately by the contractor to the satisfaction of the University of Missouri representative and Roof system manufacturer.
 - d. Ensure the roofing contractor has received a copy of each In-Progress Inspection Report within two days of the inspection. The roofing contractor is to forward the University of Missouri On-site Representative a copy of the In-Progress Inspection Report.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion of the roofing project.
 - 1. All defects noted non-compliance with the roofing specifications and details, or the recommendations of roofing system manufacturer representative should be itemized in a punch list. These items must be corrected immediately by the Installer to the satisfaction of the Owner's Representative and roofing system manufacturer technical representative.
 - 2. Ensure the roofing contractor has received a copy of the Final Inspection Report within two days of the inspection. The roofing contractor is to forward the University of Missouri On-site Representative a copy of the Final Inspection Report.

3.15 PROTECTING AND CLEANING

- A. Protect sheet membrane roofing from, not limited to the following items: dirt, grease, rust stains, roofing asphalt, scuff marks, abrasions, adhesive spills, sealant spills, membrane cuts, and any physical damages to the installed Roof system manufacturer roofing system during the construction period.
- B. Upon completion of the Work, dispose of, away from the Site, all debris, trash, containers, fasteners, roofing remnants and scraps.

- C. **The completed “Roof” shall be washed with water and the University of Missouri approved cleaner to remove all dirt, stains, adhesive and sealant spills, and any residue from roof membrane.**

3.16 ACCEPTANCE

- A. Prior to demobilization from the site, the roofing system manufacturer’s project manager, University of Missouri’s representative(s), roofing system manufacturer’s designated field technical representative and Installer’s project manager, production crew superintendent, and project’s roofing foreman shall review the completed work.
- B. Installer and University of Missouri representative shall inspect the completed roofing system for any uneven cover boards, loose or improperly attached insulation or cover boards, ponding of water, un-adhered membrane and membrane flashing, membrane damage, dirt, rust stains, roofing asphalt, grease, scuff marks, cuts, abrasions, adhesive spills, and sealant spills.
- C. All defects noted noncompliance with the project’s bid documents will be itemized in a punch list. Any non-compliance item shall be removed and/or repaired immediately by the Installer to the satisfaction of the University of Missouri representative, and to roofing system manufacturer.
- D. The noted deficiencies shall be repaired or replaced to a condition free of damage and deterioration at the time of Substantial Completion Acceptance by University of Missouri’s representative, and / or to accordance of the University of Missouri project contract documents.
- E. All warranties as required for the project of this specification shall be submitted for approval prior to final payment by the University of Missouri.

END OF SECTION 07 5401

SECTION 07 5950 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of existing roofing system in preparation for a new roof membrane system with RAD containing materials.
- B. Patch roof decking associated with the removal of ducts and chimneys.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
- C. Schedule work to coincide with commencement of installation of new roofing system.

1.03 FIELD CONDITIONS

- A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Protection: Sheet polyethylene; provide weights to retain sheeting in position.
- B. Protection Board: ASTM C 208 cellulose fiber board, one face finished with mineral fiber, asphalt and kraft paper.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the existing roof surface is clear and ready for the work of this section.

3.02 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose off site.

3.03 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials the same day.
- B. Remove copper counter flashings.
- C. Remove roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets.
- D. Remove insulation and fasteners, cant strips, blocking.
- E. Remove vapor retarder.

3.04 PROTECTION

- A. Provide temporary protective sheeting over uncovered deck surfaces.
- B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.
- C. Provide surface drainage from sheeting to existing drainage facilities.
- D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION 07 5950

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SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashing, gutters, and downspouts.
- B. All associated sheet metal will be Copper.

1.02 RELATED REQUIREMENTS

- A. Section 07 3150 - Slate Shingles: Flashings associated with slate roofing.
- B. Section 07 7200 - Roof Accessories: Roof-mounted units.
- C. Section 07 9000 - Joint Sealers.
- D. Section 04 9000 - Masonry Restoration: Through wall copper flashings for stone copings.

1.03 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM B 32 - Standard Specification for Solder Metal.
- F. ASTM B 101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
- G. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- I. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.
- J. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 1.E - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: N/A

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Stainless Steel: ASTM A 666 Type 304, soft temper, 0.015 inch thick; smooth No. 4 finish.
- B. Copper: ASTM B370, cold rolled 16 oz/sq ft thick, 20 oz/sq. ft thick and 32 os/sq. ft thick (see drawings for locations); natural finish.
- C. Lead Coated Copper: ASTM B 101, 24 (7320) ounce-weight of bare copper, HOO (cold-rolled) temper.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant: Type as specified in Section 07900 (07 9005).
- E. Plastic Cement: ASTM D 4586, Type I.
- F. Solder: ASTM B 32; Sn50 (50/50) type.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, continuous lengths, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.
- G. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- I. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Downspouts: Profile as indicated to match existing. Material to match existing.
- B. Seal copper joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Insert flashings into reglets to form a tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- F. Secure gutters and downspouts in place using concealed fasteners.
- G. Slope gutters 1/4 inch per foot minimum.

END OF SECTION 07 6200

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SECTION 07720 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured curbs, equipment rails, and pedestals.
- B. Roof hatches.
- C. Attic Ventilator.
- D. Snow guards.
- E. Retrofit Roof Drain

1.02 RELATED REQUIREMENTS

- A. Section 07 3150 - Slate Shingles.
- B. Section 07 3500 - Elastomeric Membrane Roofing.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.03 REFERENCE STANDARDS

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 SUBMITTALS

- A. See Section 1.E - Special Conditions, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

- A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
 - 1. AES Manufacturing Inc.: www.aescurb.com.
 - 2. The Pate Company: www.patecurbs.com.
 - 3. RPS Accessories: www.rpscurbs.com.
 - 4. Substitutions: See Section 1.E - Special Conditions.
- B. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
 - 1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A 653/A 653M, SS Grade 33 ; G60 coating designation; 18 gage, 0.048 inch thick.
 - 2. Manufactured curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
 - 3. Provide the layouts and configurations shown on the drawings.
- C. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.
 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 3. Height Above Finished Roof Surface: 6 inches, minimum.
 4. Height Above Roof Deck: 14 inches, minimum.
- D. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
1. Provide preservative treated wood nailers along top of rails.
 2. Height Above Finished Roof Surface: 8 inches, minimum.
 3. Height Above Roof Deck: 10 inches, minimum.
- E. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.
1. Provide sliding channel welded along top edge with adjustable height steel bracket, manufactured to fit item supported.
 2. Height Above Finished Roof Surface: 6 inches, minimum.
 3. Height Above Roof Deck: 10 inches, minimum.

2.02 ROOF HATCHES

- A. Manufacturers - Roof Hatches:
1. **Bilco Co.:** www.bilco.com(Preferred)
 2. Dur-Red Products: www.dur-red.com.
 3. Milcor Inc: www.milcorinc.com.
 4. Substitutions: See Section 1.E - Special Conditions.
- B. Roof Hatches: Factory-assembled stainless steel frame and cover, complete with operating and release hardware.
1. Style: Provide flat metal covers unless otherwise indicated.
 2. Mounting: Provide frames and curbs suitable for mounting on flat roof deck.
 3. Size(s): As indicated on drawings; single-leaf style unless indicated as double-leaf.
 4. For Ladder Access: Single leaf; 30 by 54 inches.
- C. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.
 2. Finish: Stainless steel.
 3. Insulation: 1 inch rigid glass fiber, located on outside face of curb.
 4. Curb Height: 12 inches from finished surface of roof, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
 2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
 3. Finish: Stainless Steel
 4. Insulation: 1 inch rigid glass fiber.
 5. Gasket: Neoprene, continuous around cover perimeter.
- E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 2. Hinges: Heavy duty pintle type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Locking: Padlock hasp on interior.
- F. Roof Hatch Safety Railing System: Tubular steel rails attached to sides of roof hatch curb with tube rails on 2 sides and safety mechanism on exit side.
1. Railing System as manufactured by Safety Rail Source.
 - a. At Schweitzer: RHSR-SS 30" x 54"
- G. Step Industrial Access Stairway Ladder

1. Perforated stairway code compliant.
2. 24" width
3. Height to platform range- 72"-83" or what is needed.
4. Base size-77D in
5. Basis of design- 8 step industrial access stairway ladder-WISS108246

2.03 ATTIC VENTILATORS

- A. Attic Ventilators: Factory assembled, spun aluminum, natural gravity type relief unit.
 1. Model GRSR as manufactured by Greenheck.
 2. Built-in flashing flange for mounting on manufactured curb.
 - a. Coordinate curb size with attic ventilator. Approximately 24" x24"

2.04 SNOW GUARDS

- A. Snow Guards:
 1. Berger BB100 Pro
 2. Alpine Snow Bird Hybrid Pad style snow guard
 3. Owner approved based on alternate manufacturer process for approval.
- B. Snow Guards: Individual projecting metal shapes, set between roofing shingles/tiles, and mechanically fastened to roof deck.
 1. Projecting Metal Shapes: Bronze castings, triangular spike design.
 2. Finish: Copper.
 3. Placement: 3 rows at approximately 12" vertical and at intervals of 2 feet along length of roof increased over entry points.
 4. Placement: As per manufacturer requirements

2.05 RETROFIT ROOF DRAINS

- A. Factory fabricated drain intended to be installed from the roof surface and form a watertight connection to the existing plumbing and roofing system.
 1. ProSeal Retrofit Roof Drain as manufactured by Marathon Roofing Products; www.marathondrains.com.
 2. Drain Body: consisting of the drain flange and drain stem
 - a. Manufactured from copper or spun aluminum.
 - b. 12" minimum diameter flange.
 - c. 12" long minimum drain stem.
 3. Strainer Dome:
 - a. Same material as drain body.
 - b. 6" minimum height.
 4. Clamping Ring:
 - a. Same material as drain body.
 - b. Gravel stop with drainage slots.
 - c. Positive attachment to drain body.
 5. Seal: Mechanical compression seal between drain stem and existing plumbing.
 6. Size: Size determined by existing conditions and existing pipe sizes. 3" minimum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07 7200

SECTION 07 9000 - JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

- A. Section 07 3150 - Slate Shingles: Sealants required in conjunction with roofing.
- B. Section 07 5300 - Elastomeric Membrane Roofing: Sealants required in conjunction with roofing.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Sealants required in conjunction with roofing.

1.03 REFERENCE STANDARDS

- A. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
- B. ASTM C 1193 - Standard Guide for Use of Joint Sealants.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

- A. See Section 1.E - Special Conditions, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit two samples, arranged in beads 1 inch long in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with a minimum of three years' experience.

1.07 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with roofing.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 WARRANTY

- A. See Section 1.E - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five-year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Polyurethane Sealants:
 - 1. Dow Corning 790 & 795
- B. Butyl Sealants:
 - 1. Bostik Inc: www.bostik-us.com.
 - 2. Pecora Corporation: www.pecora.com.
 - 3. Substitutions: See Section 1.E - Special Conditions.

2.02 SEALANTS

- A. Sealant Type A:
 - 1. For exterior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
 - a. Control and expansion joints in coping joints.
 - b. Control and expansion joints in unit masonry.
 - c. Butt joints between metal panels.
 - d. Joints between brick and/brick.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors, windows, louvers and similar openings.
 - g. Control and expansion joints in overhead surfaces.
 - 2. Provide single-component, low-modulus, neutral cure, non-sag sealant; comply with ASTM C920, Type S or M, Grade NS
 - 3. Acceptable sealant:
 - a. Silicones
 - 1. Single Component
 - 1) Dow Corning 790
 - 2) Fire resistant
- B. Sealant Type B:
 - 1. For exterior joints in vertical and horizontal surfaces between metal window frames and pre-cast concrete tilt-up panel surfaces and between windows and metal window frames
 - 2. Acceptable products:
 - a. Dow Corning 795 Sealant
- C. Primers as recommended by manufacturer of sealant.
- D. Closed cell polyethylene backer rod of sizes required to allow for a secure fit without over compression .**2.03**

ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C 1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION 07 9000

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20 00 00 BASIC MECHANICAL CONDITIONS

20 00 01 GENERAL

- A. This Section includes general contractual, administrative and procedural requirements for the Work of Divisions 20 – 29 to supplement the requirements specified in Division 1.
- B. The organization of the Specifications into Divisions, Sections and Subsections, and the arrangement of the Plans shall not in and of itself divide the Work among the Contractors and Subcontractors nor establish the Work to be performed by any trade.
- C. The “Scope of Work” and “Work Included” under each respective sectional heading, nevertheless, attempts to segregate the Work by known contracting activities. In the final analysis, the General Contractor shall be responsible for scoping the work for each trade based on local practice to include all the Work of a given type in the related proposal, regardless of where and how identified in the Bid Documents.

20 00 02 SCOPE OF WORK

- A. This project is for a renovated lab building for University of Missouri located at 503 S College Ave; Columbia, MO.
- B. The Mechanical Work for this project shall include all material, labor and services necessary for and incidental to providing the following systems (respective Sections of the Specifications are noted in the right hand column):
 - 1. Basic Mechanical Materials and Methods 20
 - 2. Insulation Work 20
 - 3. Fire protection system 21
 - 4. Plumbing Work 22
 - 5. HVAC Piping and Equipment 23
 - 6. Air Distribution 24
 - 7. Temperature Control Systems 25

20 00 03 REFERENCES

- A. The Plans, the general provisions of the Contract, including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.
- B. All provisions and conditions cited in this Section shall apply to Work for all other sections of Divisions 20 – 29 of these Specifications.

20 00 04 REFERENCES, REGULATORY REQUIREMENTS

- A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where relevant standards have been established (see also Paragraph 20 00 60). Material and equipment, which are not covered by UL Standards, will be acceptable provided they meet safety requirements of a nationally recognized testing laboratory. Products which no nationally recognized testing laboratory accepts, lists, labels, certifies or determines to be safe will be considered if inspected or tested in accordance with national industrial standards such as NEMA or ANSI. Evidence of compliance shall include test reports and definitive submittals.

- B. Pressure vessels and pressure retaining safety devices shall be certified in accordance with applicable requirements of the ASME Boiler Code.
- C. Definitions:
 1. **“Listed”**: A product is “listed” if of a kind mentioned in a list which: Is published by a nationally recognized laboratory which makes periodic inspections of such production. States that such product meets nationally recognized standards or has been tested and found safe for use in a specified manner.
 2. **“Labeled”**: The product is “labeled” if: It embodies a valid label or other identifying mark of a nationally recognized testing laboratory such as UL, Inc. Production is inspected periodically by a nationally recognized testing laboratory. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
 3. **“Certified”**: The product is “certified” if: The product has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in specific manner. Production is inspected periodically by a nationally recognized testing laboratory. The product bears a label, tag or other record of certification.

20 00 05 DEFINITIONS

- A. The term **“unfinished space”** as used in Division 20 - 25 of the Specifications shall be a mechanical or electrical equipment room. These are rooms that are generally unpainted and accessible only to building maintenance personnel.
- B. The term **“finished space”** as used in Division 20 - 25 of the Specifications shall mean any space not defined as “unfinished space” (i.e. occupied rooms, corridors, stairways, closets, etc.).
- C. The term **“exterior”** or **“outdoors”** as used in Division 20 - 25 of the Specifications shall mean exposed to atmospheric weather conditions.
- D. The term **“interior”** or **“indoors”** as used in Division 20 - 25 of the Specifications shall mean not exposed to atmospheric weather conditions.
- E. The term **“concealed”** as used in Division 20 - 25 of the Specifications shall mean anything that is not visible in a “finished space”.
- E. The term **“inaccessible”** as used in Division 20 - 25 of the Specifications shall mean located within walls or above non-lay-in ceiling (i.e., drywall, plaster).
- G. The term **“packaged”** as used in Division 20 - 25 of the Specifications shall be construed to be a factory manufactured piece of equipment for which all components are totally assembled, piped and prewired within its own structure and ready to operate when connected to proper external mechanical and electrical services.
- H. The term **“cold piping system”** as used in Division 20 - 25 of the Specifications shall be a piping system containing media at or below 79 degrees F temperature.
- I. The term **“ambient piping system”** as used in Division 20 - 25 of the Specifications shall be a piping system containing media which is neither heated nor chilled and remains at a temperature range between 80 and 109 degrees F temperature.
- J. The term **“hot piping system”** as used in Division 20 - 25 of the Specifications shall be a piping system containing media at or above 110 degrees temperature.

- K. The term “**medical vacuum**” as used in Division 20 - 25 of the Specifications shall include vacuum, installed in accordance with NFPA 99.

20 00 06 CODES, STANDARDS, ETC.

- A. The material, workmanship and systems for Work of this Division shall comply with all applicable codes, standards, regulations and laws of the legal governmental jurisdiction at the project site.
- B. Should the Contractor perform any work that does not comply with the requirements of the applicable codes, standards, regulations, statutes, laws, acts, or which does not receive the approval of the responsible inspection authority, Contractor shall bear all costs arising in correcting the deficiencies.
- C. Applicable requirements of the current and accepted edition of the following industry standards, codes and specifications shall apply to the Work for Divisions 20 - 29:

AGA	American Gas Association	20
AMCA	Air Moving and Conditioning Association	24 00 00
ANSI	American National Standards Institute	20 10 00
API	American Petroleum Institute	23 00 00
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers	
ASME	American Society of Mechanical Engineers	20 10 00
ASSE	American Society of Sanitary Engineers	22 00 00
ASTM	American Society of Testing and Materials	20 10 00
AWS	American Welding Society	23 00 00
AWWA	American Water Works Association	22 00 00
CISPI	Cast Iron Soil Pipe Institution	22 00 00
IEEE	Institute of Electrical & Electronic Engineers	
IPCEA	Insulated Power Cable Engineers Association	
MSS	Manufacturers Standardization Society of Valve and Fitting Industry	20 10 00
NIST	Institute of Science and Technology	20 10 00
NEC	National Electric Code, including amendments by local authority having jurisdiction	
NEMA	National Electrical Manufacturers Association	
NFPA	National Fire Protection Association	21 00 00
NSF	National Sanitation Foundation	22 00 00
NIOSH	National Institute of Occupational Safety and Health	
OSHA	Occupational Safety and Health Act	
SMACNA	Sheet Metal and Air Conditioning Contractors National Association	24 00 00
UL	Underwriters Laboratory, Inc. Guidelines for Construction and Equipment of Hospital and Medical Facilities.	

END OF SECTION

20 10 00 BASIC MECHANICAL MATERIALS and METHODS

20 10 01 GENERAL

- A. This Section describes and specifies basic mechanical materials and methods to be utilized in the Work included in other sections of Divisions 20 - 25.
- B. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 25 of the Specifications.
- C. Provisions and conditions cited in this Section shall apply, where and when relevant, to Work of other sections of Divisions 20 - 25 of these Specifications.

20 10 02 REGULATORY REQUIREMENTS

- A. Work for this section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.

20 10 03 RELATED SECTIONS of the SPECIFICATIONS

- A. Requirements of the following Section(s) of the Specifications apply to Work of this Section:
- B. Division 20 - Basic Mechanical Conditions
- C. Requirements of this Section of the Specifications shall apply to Work of the following sections of Divisions 20 - 29:
 - 1. Division 20 - Insulation Work
 - 2. Division 21 - Fire Protection System
 - 3. Division 22 - Plumbing Work
 - 4. Division 23 - HVAC Piping and Equipment
 - 5. Division 24 - Air Distribution System
 - 6. Division 25 - Temperature Control System

20 10 04 WORK INCLUDED

- A. Furnish material, labor and services necessary for and incidental to the installation of the following work where shown on the Plans and as hereinafter specified. Include all necessary work in related sections of the Specifications (sub-section 20 10 03) to perform the Work completely.
- B. Identification of piping and equipment for the work of Divisions 20 - 25.
- C. Testing, adjusting and balancing of systems for the work of Divisions 20 - 25.
- D. Cleaning of piping and equipment for the work of Divisions 20 - 25.
- E. Painting of piping and equipment for the work of Divisions 20 - 25.
- F. Demolition for the work of Divisions 20 - 25.

20 10 05 WORK NOT INCLUDED

- A. Materials and methods are specified in this section for the work of Divisions 20 - 25. The Work, itself, is specified in the respective sections of Divisions 20 - 25 of the Specifications.

20 10 06 SPECIAL REQUIREMENTS

- A. Special requirements for work shall be specified in the respective sections of Divisions 20 - 25 of the Specifications.

20 10 07 ABOVE CEILING IDENTIFICATION

- A. All equipment items (i.e., pumps, fire dampers, duct access panels, VAV boxes, etc.) concealed above a ceiling shall be identified with ceiling marker tacks similar to Markserv Ceiling Markers, Equipment Locator Tacks. Provide serrated makers with retention disk. Color code equipment markers for each equipment item above ceiling. Coordinate color strategy with owner.

20 10 10 BASIC PIPING MATERIALS

A. General:

- 1. The intent of sub-sections 20 10 11, 20 10 12, and 20 10 13 is to identify materials that may be utilized for Divisions 20 - 25 Work as specified for each specific piping system. Piping, hangers, valves, fittings and joining materials for Division 21 Fire Protection shall be FM Global and U.L. listed as specified in Division 21 and may not necessarily be as specified in this section; however all methods and procedures which are not in conflict with those permitted by NFPA shall govern.
- 2. Respective piping materials shall be manufactured, fabricated and/or provided in accordance with the ANSI, ASTM, ASME or other accepted industry standard as specified herein.

20 10 11 PIPE AND TUBE

A. General:

- 1. All pipe and tube material shall be uncoated, unless specified otherwise.
- 2. Manufacturer's mill reports and applicable documents to certify the validity of procured piping materials shall be on file at the Contractor's office.

B. Copper tube:

- 1. Type K, L, and M copper tube shall be in accordance with ASTM B88. Tubing is available in various finished products and wall thickness, which must be called out as well as sizes being either "nominal" or "outside diameter" (O.D.) since there are overlaps in smaller sizes.

type	size range	annealed		application
		hard	soft	
K	1/4"-2"		x	heaviest wall, underground water (ASTM B-88)
L	1/4"-8"	x		general use, HVAC, refrigeration, plumbing (ASTM B-88)
M	1/4"-8"	x		lightest, gravity drains and vents (ASTM B-88)
DWV	1-1/4"-6"	x		plumbing drains and vents (ASTM B-306)

C. Plastic pipe:

- 1. PVC pressure rated schedule 40 (white) and schedule 80 (gray) pipe shall be in conformance with ASTM D-1785.
- 2. CPVC pressure rated Schedule 40 and Schedule 80 pipe shall be in conformance with ASTM F-441.

3. PVC DWV pipe for non-pressure applications shall be schedule 40 pipe in conformance with ASTM D-1785.
4. SDR PVC sewer pipe outside of building shall be in conformance with ASTM D-3034 and ASTM F-477.
5. Pipe for corrosive chemical DWV applications shall be Schedule 40, 25/50 plenum rated, polyvinylidene fluoride (PVDF) pipe equal to Georg Fischer "Fuseal 25/50", with material in conformance with ASTM D-3222, with dimensions and tolerances in conformance with ASTM F-1673, and shall have a flame spread less than 25 and smoke developed index of less than 50 when tested in accordance with ASTM E-84, UL 723, and NFPA 255.

20 10 12 FITTINGS

D. Copper (alloy and bronze) shall be in conformance with the following ANSI specifications:

1. Cast bronze threaded fittings: ANSI B16.15
2. Cast copper alloy solder fittings: ANSI B16.18
3. Wrought copper pressure solder fittings: ANSI B16.22
4. Cast copper DWV solder fittings: ANSI B16.23
5. Cast bronze flanged fittings: ANSI B16.24
6. Cast copper alloy for flared tubing: ANSI B16.26
7. Wrought copper DWV solder fittings: ANSI B16.29
8. Short radius 90 degrees elbows and 180 degree returns are not permitted, unless specified and/or specifically noted.

E. Grooved:

1. All grooved components shall be of one manufacturer made in accordance with ANSI B-31.1, B-31.9. Fittings shall be ANSI 150#, 300# cast of ductile iron in accordance with ASTM A-536, Grade 65-45-12. Fittings shall have an enamel finish. Segmentally welded fittings are not acceptable.
2. Only the following fittings will be accepted: Long radius (1.5 x diameter) 90° and 45° elbows, tee, reducing tee, concentric/eccentric reducers, and flange adapter nipples. Flange rings, reducing couplings, saddle/**mechanical/clamp branch** tee, and others not listed above are not acceptable.

F. Plastic:

1. PVC pressure rated fittings for schedule 40 shall be "white", socket solvent cement joint type in accordance with ASTM D-2466.
2. PVC pressure rated fittings for schedule 80 shall be "gray", threaded joint type in accordance with ASTM D-2464; and socket solvent cement joint type in accordance with ASTM D-2467. Flanges and unions shall be in accordance with ASTM F-1970.
3. CPVC pressure rated fittings for Schedule 80, threaded joint type in accordance with ASTM F-437; and socket solvent cement joint type in accordance with ASTM F-439. Flanges and unions shall be in accordance with ASTM F-1970.
4. PVC DWV fittings for non-pressure applications shall be in accordance with ASTM D-2665 and NSF Standard 14.
5. Fittings for use with Georg Fisher "Fuseal 25/50" pipe shall be molded socket type fittings of the same material, be compatible with the pipe and conform to dimensions and tolerances of ASTM F-1673. Fittings shall be fusion weld type, with integral collar with electrical resistance coil, duplex electrical connector for remote power supply, and band clamps. Final connections to fixtures and appliances shall be mechanical joint.

G. Miscellaneous

1. Dielectric flanges and unions:
2. Dielectric unions and flange unions shall be required in piping systems where an electrically insulated connection is needed to separate dissimilar metals from producing galvanic or electrolytic action. Unions shall be rated for 250#, flange unions for 175#. Range: unions 1/2" - 2"; flange unions 1-1/2" - 12".
3. Steel threaded nipples:
4. General use: Made from ASTM A-120 pipe in standard (schedule 40) and extra strong (schedule 80). Available black and galvanized, range 1/8" - 6" pipe diameters.
5. High-pressure application: Made from ASTM A-53 seamless pipe and ASTM A106 seamless pressure tube in standard (schedule 40) and extra strong (schedule 80). Available black only, range 2" - 6" pipe diameters.
6. Close nipples are not permitted.

20 10 13 VALVES

A. General:

1. It is indented that valves specifications are for high quality HVAC / Plumbing applications, not lesser quality "Contractor / Value / Economy" series. Valves produced internationally shall be from the Manufacturer's owned facilities. Valves shall not be manufactured by third party OEM suppliers. Valve submittal shall indicate where the valve is assembled and tested.
2. When two or more valves of the same type are to be used in the same service, all valves of this type shall be of the same manufacturer.
3. Only general valve series are specified. Valves shall have all options, trim, seat material, and accessories as specified whether or not listed as a prefix, suffix or valve number.
4. All valve manufacturers and models listed shall be considered as "acceptable manufacturers" and may be submitted without concern from subsection 20 00 62
5. All valves for use in "cold" piping shall have stem or neck extensions allowing proper insulation and a continuous vapor barrier.
6. No asbestos packing allowed.

B. Ball Valve:

1. 2" and smaller: Bronze ASTM B584 (or low lead bronze for lead-free), 2-piece body, 600 psi WOG, quarter turn lever handle, blow-out proof stem, stem extension (for "cold" applications), full port, virgin TFE seats, all stainless steel trim, threaded or soldered ends. Nibco S-585-70-66, Apollo 77-240, Watts Series B-6081, Hammond 8311 or approved equivalent. Full port valves 2 1/2" and 3" the same model numbers as the 2" and smaller valves are also acceptable.
2. Gauge cocks where not specified or specifically identified shall be 1/4" bronze 2 piece body ball valves with lever handle and threaded ends per the above specification.
3. Drain valves and air vents shall be 3/4" bronze 2 piece body ball valves per the above specification, with 3/4" hose end adapter cap and chain. In 1/2" through 2" pipe, contractor may use Webstone model T-drain.

C. Balancing Valves:

1. General: Balance valves shall provide positive shut-off for service and shall have adjustable memory stops to allow returning to original balanced position after servicing.

2. 3" and smaller: Body shall be bronze or Dezincification Resistant Brass rated to 300 psig. Valves shall be multi-turn, provide positive shut off; include: position indication, memory stops, integral pressure tap ports provided with "drip caps". Quarter turn valves are not acceptable. Balance valves shall be Nibco 1810, Tour and Anderson 786/787, Apollo 59A, Armstrong CBV, Macon Balancing STV/L Series or approved equivalent.

20 10 14 STRAINERS

A. General:

1. When two or more strainers of the same type are to be used in the same service, all strainers of this type shall be of the same manufacturer.
2. Only general strainer series are specified. Strainers shall have all options, trim, and accessories as specified whether or not listed as a prefix, suffix or the model number.
3. All manufacturers and models listed shall be considered as "acceptable manufacturers" and may be submitted without concern from subsection 150620.

B. "Y" Strainers:

1. 2-1/2" through 12": ANSI 125 lb. (125 psi at 353°F, 200 psi at 150°F), ASTM A126-B cast iron body and cover, ASTM A240 304 stainless steel perforated sheetmetal with .045" openings for steam and 1/4" diameter for water service. Mueller 751, Keckley A, Armstrong A-FL-125, Spirax/Sarco F-125, Watts 77F-D, or approved equivalent.

20 10 20 MISCELLANEOUS MATERIALS

20 10 21 SLEEVES (NON-WATER PROOF, NON-FIRE RATED)

- A. Piping passing through non-fire rated interior walls or floors shall be neatly field cut round holes with hole saws for non-masonry/concrete, and core drill for masonry/concrete. "Beating" an opening in a gypsum or masonry wall shall not be accepted.
- B. Install Schedule 40 pipe sleeves where pipes passing through floors of spaces where water could leak to the area below (i.e., mechanical rooms, janitor closets, kitchens, etc.). ID of pipe sleeve shall accommodate pipe insulation. Pipe sleeve shall extend a minimum of 4" above the finished floor, grout the annular space between the oversized core drill in the floor and the sleeve.
- C. In new construction, field formed walls or floors, the contractor shall install appropriate blocking or material or pipe sleeves.

20 10 22 WATER SEALS

- A. All penetrations through **interior to exterior** walls or floors shall be sealed water tight using the methods below.
- B. **In existing construction**, holes shall be core drilled to the manufacturer's recommended size for the type and size of pipe to be sealed.
- C. The annular space between pipes/conduits and interior to exterior sleeves and sleeve penetrations for service temperatures below 250°F shall be sealed with GPT Industries "Link Seal" Model S-316 EPDM rubber with 316 stainless steel hardware. For service temperatures between 250°F-450°F and model "T" shall be used. Closure seals sizing shall be in accordance with manufacturer's data and application.

- D. The Contractor shall submit a schedule of sleeves and seals to the Architect/Engineer for approval indicating the following: carrier pipe size, location, type of sleeve - fabricated with dimensional details or purchased with manufacturer's support information, seal requirements - none, fire rated, non-fire rate or "Link Seal" with respective support data.
- E. Sleeves and seals manufactured by GPT Industries/PSI, Flexicraft Industries, Advance Products & Systems, Metraflex, or equivalent.

20 10 23 SEALS, NON-FIRE RATED

- A. All penetrations through non-rated walls, floors, etc., shall be sealed for draft stopping with caulk, putty, etc., designed for this use.

20 10 24 ESCUTCHEONS

- A. Wall, floor, and ceiling plates shall be spun brass, plain pattern, chrome plated, spring type or setscrew fastening. Provide escutcheons for all exposed piping in finished spaces.

20 10 25 ROOF PENETRATIONS

- A. All roof penetrations shall be made in a manner that is consistent with the roofing installation and shall maintain the existing roof warranty. Coordinate with the roof warranty supplier as required.
- B. Supports for roof mounted equipment shall also meet the requirements listed in paragraph A. above. All roof supports shall be anchored to the existing structure in a manner that will transmit all loads including seismic and wind loads from the equipment supports through the roofing to the building structure.

20 10 27 RESTRICTIONS, GENERAL FOR ALL PIPING SYSTEMS

- A. Do not use gaskets or packing containing asbestos.
- B. Selections of material and equipment and options for substitution shall conform to the requirements of Sub-section 20 00 60, MATERIAL and EQUIPMENT.
- C. "Bull head" tee connections are not permitted, unless approved by the Engineer.
- D. Close nipples and bushing reducers are not permitted.
- E. Mitered elbows are not permitted.
- F. Unprotected, non-smoke rated plastic piping material is not permitted in above-the-ceiling spaces used as return air plenums, or exposed in any occupied space.
- G. Black and galvanized pipe, fittings, nipples and specialties are not permitted in water piping systems where copper and/or brass are the basic materials.
- H. Short radius 90-degree elbows and 180-degree returns are not permitted, unless specified and/or specifically noted.
- I. The use of pipe hooks, chain and perforated band iron are not permitted for hanging or supporting piping.
- J. Power driven inserts and attachments are not permitted unless approved by the Architect/Engineer on express request by the Contractor.

- K. Plastic piping systems shall not be tested pneumatically.

20 10 30 JOINTS AND CONNECTION METHODS

20 10 31 THREADED

- A. Threads for all screwed pipe systems shall be American National Standard taper threads in accordance with ANSI B-1.201.
- B. Threads shall be full, sharp, clean and free of fins and burrs. Pipe ends shall be reamed to remove internal burrs.
- C. Threaded connections shall be joined using teflon sealing tape applied to the male threads only.
- D. This sub-section does not apply to threads for compression, flare and sanitary drainage slip type drainage fittings.

20 10 32 GROOVED

- A. Grooved joints for grooved couplings and fittings shall be in accordance with accepted manufacturer's specifications and practices.
- B. Grooves may be cut or rolled in accordance with manufacturer's recommendations for type of pipe, sizes and thicknesses specified for respective systems.
- C. Gaskets shall be suitable for the temperature, pressure and compatibility with the fluid contained therein. Unless specifically specified otherwise or incompatibility with the system, gaskets shall be EPDM grade E.
- D. Grooved couplings shall be ASTM-A47 grooved malleable iron clamp type couplings as manufactured by Victaulic or equivalent.
- E. Grooved couplings for vibration isolation or as unions at equipment connections shall be similar to Victaulic Style 77; all others shall be similar to Victaulic Style 07.

20 10 33 SOLDERED

- A. Soldered connections shall be made in accordance with recommendations of the current edition of the Copper Tube Handbook of the Copper Development Association or as hereinafter specified.
- B. General criteria for soldered joints shall be as follows:
 - 1. Copper tubing shall be square-end cut by varied methods at the Contractor's option. The ends of the tubing shall be reamed to remove both internal and external burrs.
 - 2. Joints for copper piping for hydronic systems, temperature controls, DWV systems and other applications of fluids below 250 degrees F. shall be soldered with 95-5 Tin Antimony. 50-50 Tin Lead solder shall not be used.
 - 3. Cleaning of tubing and fittings, application of flux and heat, purging and cooling shall be in accordance with recommendations of solder and brazing alloy manufacturers for the joint type and material specified in the respective "PIPING MATERIAL SCHEDULE" in Section 230000.

- A. Mechanical joints and joining material shall meet the requirements of ANSI/AWWA C111/A21.11.
- B. Clean bell and plain end, and lubricate gasket as recommended by manufacturer. The joint area must be free of dirt.
- C. All bolts and tie rods shall be galvanized. Tighten bolt to 75-90 ft.-lbs. torque alternating from top to bottom maintaining equal distance between face and gland during tightening.
- D. Where flanged joints are used to interface with equipment or other piping materials they shall be flanged joints in accordance with ANSI B16.1. The gaskets shall be full forced, made of rubber and shall meet the requirements of ANSI B16.21.
- E. Joints shall be restrained with EBBA Megalug, Romac Industries Romagrip, or approved equivalent. Thrust blocks or other restrains are not acceptable.

20 10 36 PLASTIC

- A. Solvent cement: Joints in PVC piping shall be made in accordance with manufacturer's guidelines and instructions for CPVC handling, joint preparation, type of primer and solvent/cement, curing time, temperature and testing.
 1. PVC pressure piping and DWV - solvent cement shall conform to ASTM D-2564 and primer shall conform to ASTM F-656.
 2. CPVC pressure piping - solvent cement shall conform to ASTM F-493.
 3. SDR sewer pipe - ASTM D-2855.
- B. Fusion welded: Joints shall be made in accordance with the manufacturer's instructions.
- C. Gasket: Elastomeric seals (gaskets) for joining plastic piping shall conform to the following:
 1. PVC water distribution piping - AWWA C-900, ASTM D-2774 and ASTM D-3139.
 2. SDR sewer piping - ASTM D-2321 and ASTM D-3034.

20 10 40 HANGERS, SHIELDS, SUPPORTS AND ANCHORS

- A. General:
 1. All hanger devices (e.g. - concrete inserts, expansion anchors, clamps, pipe hangers, strut, etc.) shall be UL approved for the intended service. Material shall be applied within the load limitations prescribed by the respective manufacturer. Loads transmitted to the building shall be within the limitations of the structure.
 2. Acceptable manufacturers of hanger material are Anvil International, B-Line Systems, Inc., Tolco, PHD Manufacturing, ERICO/Michigan Hanger Co., National Pipe Hanger Corp.
 3. **This section shall not apply to Division 21 Fire Protection.**

20 10 41 HANGERS

- A. Piping shall be supported from the building structure, walls, and floors. Piping shall not be supported from other piping, ductwork, conduits, etc. Loads shall be within the allowable load of building component that is connected to. Piping loads shall include, but not limited to, the weight of the piping, valves, specialties, insulation, pipe covering, pipe content, pressure test media content, wind, snow, seismic, etc.

- B. Where piping is indicated on common trapeze hangers, racks, stanchions or brackets, the various trade contractors involved shall agree to a mutually acceptable arrangement among themselves, but each shall be responsible for the correctness and compliance of their work.
- C. Pipe hangers, supports, etc. for “cold” piping systems shall have hangers sized for the outside diameter of the insulation in order to maintain a continuous vapor barrier.
- D. Pipe hangers for all “ambient” and “hot” piping systems shall be the same size as the pipe, except at roller hangers or supports where the treatment shall be the same as for “cold” piping systems.
- E. Hangers, and other supports, anchors, guides, etc. in direct contact with copper piping material shall be copper plated. All others shall be electro-plated for indoor use.
- E. The use of pipe hooks, chain, perforated band iron, wire, or cable are not permitted for hanging or supporting piping.
- G. Singular, horizontal, suspended piping above grade shall be hung with pipe hangers per the following schedule, unless noted otherwise:

<u>pipe sizes</u>	<u>piping application</u>	<u>Anvil International type and figure number</u>
3" and smaller	not subject to expansion/contraction	adjustable ring, #69

1. hanger to be sized for outside diameter of insulation and to be used with insulation protection shield, figure 167.
 2. hanger to be sized for outside diameter of insulation and to be used with insulation protection saddle, figure #160 through figure #165.
- H. Hangers, supports, etc. shall position the piping properly in the work, and provide for expansion and contraction.
 - I. Vertical piping shall be supported at each floor level with riser clamps bearing on the building structure or pipe sleeve.
 - J. JWall brackets shall be field fabricated to meet the anticipated loads. The minimum brace angle shall be 45° from the horizontal.

20 10 42 HANGER RODS AND HANGER SPACING

- A. Where “All-thread” rod is used it shall be galvanized, cadmium or zinc electro-plated. Where plain rod is used the threads shall be a minimum of 2” in length on each end.
- B. Hangers and hanger rod spacing for metallic piping shall be provided and installed in accordance with the Building Codes or the following schedule, whichever is more stringent:

<u>pipe size</u>	<u>rod diameter</u>	<u>max. hanger spacing</u>
1-1/4" & smaller	3/8" diameter	8' on centers
1-1/2" & 2"	3/8" "	10' oc
2-1/2" & 3"	1/2" "	10' oc

- C. Hangers for non-metallic piping shall be spaced in accordance with the Building Codes or the following schedule, whichever is more stringent:

<u>pipe size</u>	<u>rod diameter</u>	<u>max. hanger spacing</u>
1" & smaller	3/8" diameter	4' oc
1-1/4" - 2"	3/8" "	5' oc
3"	1/2" "	6' oc
4"	5/8" "	7' oc
6" & larger	3/4" "	8' oc

20 10 43 ANCHORING

A. Anchors for piping, ductwork, or equipment in new concrete construction may be suspended at the Contractor's option, or as shown on the plans, from inserts placed in the concrete as it is poured-in-place. Mechanical equipment rooms shall have inserts placed at a maximum of 4 ft. centers.

<u>hanger rod size</u>	<u>Grinnell insert figure number</u>
7/8" or smaller	single - CB universal, figure #282
7/8" or smaller	multiple - 1-5/8" x 1" continuous strut, #PS 449

B. Anchors for piping, ductwork, or equipment in existing concrete shall be suspended from epoxy resin set anchors, installed per the manufacturer's recommendations set into holes drilled into the concrete. Anchors shall be UL and/or FM approved, and applied within the allowable working load ratings for the respective size. Cataloged load values shall be derated by one third for seismic allowances. Minimum embedment depth shall be 2/3 of concrete thickness. Field pullout test shall be performed when requested by the Engineer. Anchors shall be Hilti type HVA.

C. Power driven inserts and attachments are not permitted unless approved by the Architect/Engineer on express request by the Contractor.

D. In all cases, anchor loading shall be based on hanger spacing, weight of the pipe to be supported when full and insulated, weight of any additional loads imposed upon the anchor, wind loading, seismic loading, quality of the material that the anchor is being installed in, etc. The Contractor shall verify in the field that the anchors used and the materials that they are being installed in are suitable for the load imposed and shall bring any problems to the attention of the Owner's Representative in writing immediately.

E. Where anchors are loaded in shear in existing concrete structure, suitably sized and installed wedge type anchors may be used. Wedge type anchors shall be Hilti Kwik Bolt II.

20 10 44 SEISMIC RESTRAINT

A. All materials and workmanship shall specifically comply with the above listed Building Code with respect to seismic requirements for the support and anchorage of all mechanical systems and equipment as installed on this project. Lateral forces to be restrained shall be as required by ASCE 7 Section 11 and 13 Architectural, Mechanical, and Electrical Components and Systems. Refer to structural drawings and/or Geotechnical Report for design values.

-Site Class (ASCE 7-05, Table 11.4-1 and 11.4-2)	D
-Seismic Occupancy Category	II
-Seismic Design Category	C
-Seismic Importance Factor	1.0 (items not listed below)
Fume Hood Exhaust Duct	1.5
Fume Hood Chemical Cabinet Vent Duct	1.5

ERU-01	1.5
EF-1/2 Assembly	1.5
Acid Vent Piping	1.5
Fire Sprinkler Piping	1.5
Phoenix Exhaust Air Valves	1.5

- B. All piping support and restraint details and practices shall conform to the publication "Seismic Restraint Manual Guidelines for Mechanical Systems" by SMACNA, 2008 Edition, and/or "Seismic Restraints" by B-Line systems, Inc.
- C. DELEGATED DESIGN: Design hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, herein referred to as Seismic engineer. Prepare drawings, calculations and details for any anchorage, bracing and/or sway bracing for seismic restraint as required by the local codes and Authority Having Jurisdiction. Seismic engineer shall inspect the final installation for compliance with the approved Seismic shop drawings. Seismic engineer to identify items that need to be corrected or changed and provide contractor additional/revised drawings as required.
- D. SUBMITTALS:
1. SHOP DRAWINGS: Submit drawings, calculations and details shall be signed and sealed by a Professional Engineer licensed in the State of the Project's location.
 2. CLOSEOUT: As-built seismic drawings with Letter from Seismic engineer stating that the completed installation meets the design.
- E. INSTALLATION: Contractor shall only use those materials submitted and approved. Contractor shall notify Seismic Engineer when actual installation differs from the approved Seismic shop drawing.

20 10 50 BASIC MECHANICAL METHODS - GENERAL

20 10 51 INTENT OF PROJECT DOCUMENTS

- A. Install the Work in accordance with the Project Documentation and considerations enumerated in Subsection 20 00 01, GENERAL (Project Documents).

20 10 52 ARRANGEMENT OF WORK

- A. All Work shall be arranged so that hangers and supports for the mechanical equipment and materials shall be within the load limitations of the structure and the respective hanger and/or support.
- B. Piping that is required to pitch shall have priority over piping that does not pitch. Work which cannot be changed in elevation shall have priority over that which can be moved. Offsets, transitions and changes in direction shall be made in piping and ductwork to maintain headroom and pitch whether or not indicated on the Plans. The Contractor shall provide air vents, traps, dirt legs, drains, lifts, sanitary vents, mechanical vent lines, etc. as required to install the mechanical systems for proper operation and maintenance.
- C. Do not install work in the immediate proximity of electrical components (e.g. - panels, switches, controls, boxes, etc.) in equipment rooms. Drip pans above and/or around electrical equipment are not permitted.
- D. Aluminum and copper products shall not be encased in concrete.

- E. Work in “finished spaces” shall be concealed within walls, chases or above the ceiling unless specifically indicated otherwise. Install the Work to coordinate with other trades and to conform to the architectural reflected ceiling plan.
- E. The work shall be installed parallel with the building lines unless specifically shown or noted otherwise.

20 10 53 COORDINATION

- A. It shall be the Contractor's responsibility to coordinate their work with the work of other trades, and with the architectural and structural drawings. Where physical interferences cannot be resolved between the trades, or when encountered in the field, the Contractor shall prepare composite drawings at a scale of not less than 3/8" = 1'-0" clearly showing the Work of Divisions 20 - 29 in relation to the Work of others to identify the conflict. Submit a proposed resolution to the Architect/Engineer for approval in accordance with Sub-sections 20 00 01, GENERAL (Project Documents) and 20 10 06, SUBMITTALS.
 - 1. Do not proceed with Work in question until the matter is mutually resolved among the involved parties, and adequate information has been submitted to the Architect/Engineer for review. No additional compensation shall be granted for modifications and execution of the resolution(s). Modifications are to be incorporated in the “as-built” drawings.
- B. Contractor shall review the Project Documents, site conditions, and the requirements of other disciplines, and shall report any discrepancies between them to the Architect/Engineer and obtain from him written permission for changes necessary in the Mechanical Work. Subsequent clarification(s) by the Architect/Engineer will not be a change in scope of the Work. The Contractor at no addition in the contract price shall perform any such modifications required.
- D. Contractor shall verify tie-in locations to verify sizes, direction of flow (via pressure or physical tracing, not labels), materials, elevations, etc. prior to commencing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.
- E. The Contractor shall furnish and properly install all sleeves, slots, chases, openings, recesses, supports, anchors and anchor bolts required for his Work in coordination with the other trades as the building is erected.
- F. The expenses for changes required by neglect in executing, coordinating or scheduling the Work properly or avoiding conflicts shall be borne by the Contractor precipitating the issue requiring the changes.

20 10 54 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handling of equipment and material are the Contractor's responsibilities. The Contractor shall perform the Work in accordance with the following criteria:
 - 1. Delivery shall be arranged by the Contractor (including Owner furnished items) for the expeditious and economical pursuit of the Work and to meet the scheduling requirements of the Contract.

20 10 55 CLEANING OF PIPING SYSTEMS

- A. The Contractor shall clean the respective piping system(s) that are included in his scope of work. All systems shall be flushed with water or air (depending on ultimate use) to relieve any congestion and internally cleanse the respective piping system. The Contractor shall provide all flushing media in sufficient quantity, inlet connections, discharge or drainage

outlets and any temporary provisions to protect components, or remove it, to facilitate the flushing. Clean and replace all strainer screens and filters. Flush clean and drain all low points in the piping.

- B. Owner's representative shall be present for flushing, cleaning, and rinsing. Water treatment representative must check water after rinsing to insure all chemical cleaner has been removed and the Alkalinity of the rinse water is equal to that of the make-up water.
- C. All pipe systems for hydronic applications shall be flushed continuously with 100% city water make-up until the water runs clean from all drain locations. Each piping system shall be subsequently cleaned with recommended dosage of an approved pre-cleaning chemical designed to remove deposition such as pipe dope, oils, loose rust, mill scale and other extraneous materials for a minimum period of twenty-four (24) hours then drained, refilled, and rinsed clean. Flushing before and rinsing after cleaning shall be supplying constant make-up water while draining at all system low points and drains.

20 10 56 PRESSURE TESTING

- A. The Contractor shall submit a schedule at the beginning of the Work of the piping systems that are to be pressure tested, and indicate whether tests will be for an entire or partial system. Entire piping systems shall be pressure tested at one time unless it is not possible or practical.
- B. All piping to be insulated or concealed shall be pressure tested prior to the application of the insulation or concealment.
- C. A representative of the Architect/Engineer shall witness all pressure testing. The Contractor shall notify the Architect/Engineer at least three (3) days prior to the test date.
- D. Each piping system shall be tested per the method, test pressure, and test duration as specified in the Piping Material Schedules.
- E. The Contractor shall provide all test media, measuring devices, inlet connections, test measurement connections, and disposal of test media. The Contractor shall protect, isolate and/or remove piping system components that can not be subjected to test pressures.
- E. Hammer each joint in welded or soldered piping while under test. Leaks shall be repaired and the test(s) repeated until the respective piping system is tight.

20 10 60 BASIC MECHANICAL METHODS - INSTALLATION

20 10 61 GENERAL

- A. The Contractor shall install all equipment and material as specified in the Project Documents. The Contractor shall review the installation requirements, and provide all of the appurtenances and accessories required for complete systems and a functioning installation. The Contractor shall be prepared to submit installation details and procedures where specified or requested for approval by the Architect/Engineer.
- B. The Contractor shall follow the manufacturer's instructions for the handling, temporary storage, protection and installation of the respective equipment and material. The Contractor shall promptly notify the Architect/Engineer in writing of any discrepancy or conflict between the Project Documents and the manufacturer's instructions, and request clarification. Unless

there is a specific change in the scope of work, no additional compensation shall be granted for modification(s) and execution of the clarification.

- C. Work performed that does not comply with the manufacturer's instructions, any approval or instructions from the Architect/Engineer, or that causes a significant and/or unapproved deviation from the intent of the Project Documents shall not be grounds for additional compensation for costs to modify the Work in a manner directed by and to the satisfaction of the Architect/Engineer.
- D. All Work shall be installed to permit access and/or removal of components e.g. - coils, fan wheels and shafts, filters, guards, bearings, motors, mechanical drives, etc. that require periodic maintenance, servicing, repair and/or replacement. Equipment, piping, ductwork, conduit and raceways shall be arranged to permit access to valves, motors, motor and temperature controls, and to clear the opening of doors and access panels.
- E. Welded attachments to the building structure are not permitted.

20 10 62 PIPING

- A. All piping shall be properly installed and supported with adequate provisions for clearance from other work, for expansion, contraction, slope, anchorage and prevention of transmission of vibration.
- B. Piping shall be generally installed parallel to building lines in the most expeditious and economical manner and to facilitate servicing. Piping shall be positioned and installed to provide noiseless circulation, and pitched to provide drainage and avoid air pockets. Valves and specialties shall be located to provide proper function and be readily accessible for servicing and maintenance.
- C. All piping connecting to equipment shall be installed without springing and any strain at final connections. The Contractor may be requested to disconnect piping to demonstrate that the piping has been so installed.
- D. Changes in direction in the piping shall be made with manufactured fittings only. All elbows shall be long radius (1.5 x diameter) unless specifically noted otherwise. Bending may be permitted on submittal for approval of a satisfactory procedure to the Architect/Engineer for approval. Bending is to be accomplished with hydraulic type equipment producing no malformations in the piping.
- E. Full size branch connections and branch connections one size smaller in steel piping shall be made with manufactured fittings only. Branch connections two sizes and smaller than the main run may, in special cases with the Engineer's written permission, be made with manufactured fittings, weld-o-let or thread-o-let type fittings for welded piping construction, saddle type fittings for grooved piping construction or a pipe-to-pipe nozzle weld. Small branch connections for thermometers, pressure gauges, controls, etc. may be made with nozzle welded 3000# forged steel threaded couplings, thread-o-lets or saddle fittings. For insulated piping, provide branch connections with sufficient "neck" length to extend beyond the thickness of the insulation.
- F. Changes in direction in piping systems using hard temper copper tubing shall be made with manufactured and cataloged elbow fittings. Branch connections and reductions in all copper tubing systems shall be made with tee and reducer fittings. At the Contractor's option, utilizing a "Tee Turner" tool and corresponding procedure may provide branch connections. These joints shall be brazed and not soldered.

- G. Minimum slope for piping shall be provided in accordance with the following schedule, unless otherwise specified, noted or shown:

Type of Piping Fluid Conveyed	System Component	Pitch	Direction of Fall
Sewer, sanitary	main/branch	1/8"/Ft.	w/flow
Chilled/heating water	supply/return main	1"/40Ft.	from vent
Chilled/heating water	runouts to risers	1/8"/Ft.	back to mains
Condensate drain		1"/20Ft.	w/flow

- H. All piping materials shall be physically cleaned internally and externally of mill scale, oxidation, grease, oil, dirt, mud, loose and foreign matter before fabrication and installation.
- I. All open ends of piping and equipment shall be closed during fabrication and installation to keep dirt and foreign matter out of the Work.

20 10 63 VALVES

- A. Shut-off valves shall be provided at all inlet and outlet connections to equipment, at major branch connections to mains, where required for normal service, and where shown on the drawings, flow diagrams or details.
- B. Valves shall be the same size as the adjacent piping, except for control valves furnished in Division 25.
- C. Valves shall be accessible and free from interference when operated. Valves shall be installed with the stem on or above horizontal.
- D. Valves shall be packed and glands adjusted before final acceptance.

20 10 64 EQUIPMENT

- A. The Contractor shall furnish and install the necessary frames, stands, brackets, stiff-legs, hangers, etc. to support or suspend the equipment and material that require this installation arrangement. The Contractor shall be responsible for the size, quantity, location and design of the supports and suspensions. The design shall permit no deflection of the support, the suspension arrangement or related building members, nor impart any vibration into the building structure. Loads transmitted to the building shall be within the limitations of and distributed satisfactorily to the structure. Designs for supports and suspensions shall be submitted for approval to the Architect/Engineer. Any attachment to the floor shall be provided with a minimum of 1" thick concrete or grout between the base and the floor. All associated ferrous metal parts shall be painted or galvanized. Painting shall consist of one (1) coat of base primer on properly prepared surfaces and one (1) coat of rust inhibiting enamel, color selected by the Architect/Engineer.
- B. Each exposed mechanical drive and rotating shaft shall be provided with a protective guard. The guards may be provided with the respective equipment or may be field fabricated. The guard shall be constructed to comply with the appropriate safety requirements of the National Institute of Safety and Health and OSHA. Provide adequate and proper access for speed measurements for all rotating shafts. Guards shall not interfere with the lubrication of equipment nor restrict the airflow into fan inlets. The design for field fabricated guards shall be submitted for approval to the Architect/Engineer.
- C. Grease fittings for bearings shall be extended to accessible locations.

D. Installation Instruction

1. Equipment shall be set level, plumb, properly oriented, aligned and secured in the location shown on the drawings.
2. Shims used for leveling shall be of size sufficient to cover the entire bearing surface except where shims are used to level preparatory to grouting. Shims used in conjunction with grouting shall be located to properly support equipment at load points to prevent any distortion.
3. Assembly and installation of the equipment shall be in strict compliance with the equipment vendor's instructions.
4. Where specified, equipment shall be assembled, installed, inspected and adjusted under the supervision of the Vendor's representative.
5. Lugs, saddles, supports, covers or similar components which have been shipped separately or loose shall be located and attached by the Contractor by means of welds or bolting.
6. Holes in structural steel required for installation of equipment shall be drilled as required.
7. Contractor shall supply and install self-anchoring anchors.
8. The Contractor shall grout under the equipment to effect a firm permanent setting as required.
9. Upon completion of installation the Contractor shall remove all staging, blocking and construction debris from the equipment.
10. The Contractor shall check all packaged or pre-assembled equipment to make sure that all packing shims and blocking is removed before rotating, running or testing the equipment.
- 11.

20 10 65 MISCELLANEOUS

A. Sleeves, inserts, etc.

1. The Contractor shall furnish and properly install sleeves, inserts, supports, anchors and anchor bolts required for his Work. The size, quantity and location of chases, openings and recesses in the building structure shall be the responsibility of the Contractor performing the Work that requires these considerations. Patching of oversized openings and finishing thereof shall be the responsibility of the trade or Contractor requiring the opening.
2. Sleeves shall be provided for all penetrations through the building structure. Sleeves through floors shall extend 1" above the finished floor except where otherwise noted; sleeves through walls, partitions or structural members shall be flush with the exterior surface on both sides. Sleeves shall sized to include the pipe/duct insulation.
3. The space between the sleeve (or opening in the structure) and the pipe/duct or outside of the insulation of penetrations through fire rated components of the building shall be fire stopped, see Section 20 10 20 Miscellaneous Piping Materials. Penetrations through non-rated components of the building shall be draft stopped, see Section 20 10 20 Miscellaneous Piping Materials.

B. Unions and flanges:

1. A ground joint type union shall be provided in threaded and sweat joint piping, 2" and smaller pipe or tube size, down-stream of each branch shut-off valve, control valve and specialty item, the inlet and outlet connections of each piece of equipment, and where shown on the drawings.

C. Interconnections between dissimilar piping material systems shall be made with fittings manufactured for the specific application.

20 10 70 BASIC MECHANICAL METHODS - RELATED WORK

20 10 71 DEMOLITION

A. Miscellaneous:

1. Loose ends of mechanical systems shall be capped and/or sealed in a safe and secure manner approved by the Architect/Engineer.
2. Dead legs of branch piping are not permitted unless a cap is specifically shown on the drawings. Where a cap is not shown and the drawings indicate to cap piping, the Contractor shall remove branch piping back to the main and cap at that point.

20 10 72 CUTTING AND PATCHING

- A.** The basic premise of this Sub-section is that the cutting and patching (where required) are performed in existing building components.
- B.** The Contractor requiring the penetration of or the access way in the building structure to fulfill the intent of the Project Documents for his Work shall be responsible for the cutting and the subsequent patching in accordance with the following criteria:
1. No structural component of the building shall be cut or violated without express approval of the Architect/Engineer.
 2. The Contractor shall verify the presence of any concealed utility or service within the structure (walls, roof, floor, etc.) in question, and shall be responsible for maintaining continuity and/or replacing it.
- C.** "Patching" shall be construed as the repairing or replacing of the building structure to return it to an original or new condition, in the opinion of the Owner and/or Architect/Engineer, as existed prior to the cutting.
- D.** Patching and finishing work shall be the responsibility of the Contractor requiring the cutting. The patching shall match all the substantive and visual aspects of the structure and adjacent surfaces. Restoration and finishes shall be as specified and executed in the respective sections, schedules and/or details of the Project Documents for the general construction work. Completed work and any special requirements shall be subject to approval by and satisfaction of the Architect/Engineer.

20 10 74 LUBRICATION

- A.** Provide all oil and grease for the operation of all equipment until acceptance. The Mechanical Contractor and Subcontractors shall be held responsible for all damage to bearing while the equipment is being operated by them up to the date of acceptance of the equipment. Protect all bearings during installation and thoroughly grease steel shafts and other unpainted steel surfaces to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. For equipment that is received void (dry) of lubrication the Contractor shall lubricate the equipment before storing to prevent internal damage to the equipment.

20 10 75 DRAINING, FILLING AND VENTING SYSTEMS

- A.** The Contractor shall provide all required labor for draining, filling and venting of new and modified systems as many times as required during construction and for all phasing activities.

- B. Where draining and filling systems affects other systems or the Owner's normal operations, then they shall be scheduled at least 24 hours in advance with the Owner and shall be carried out to minimize such disruptions.

20 10 80 TESTING, ADJUSTING AND BALANCING

20 10 81 GENERAL

- A. TAB is by a Third Party TAB firm hired by the Owner.
- B. TAB During Construction: First choice is to have TAB provided by MU Campus Facilities Energy Management (EM). For TAB provider other than EM, PM shall work together to select consultant that is best suited to meet project needs.
- C. Testing for current (preconstruction) performance prior to system modification is required during project evaluation and/or design. Owner will perform it for every project to confirm there is adequate air capacity to support the future or existing project program. This is required even if there is no anticipated increased load on the air handling system to confirm the system still has adequate capacity to support existing programs. Consultant shall inform PM of any specific information that needs to be captured for their use.
- D. Minimum allowable airflow during balancing shall be the design CFM stated on the drawings. This must be stated in the TAB specifications.
- E. TAB specification provided in the bid package shall describe the Contractor's scope of work to support Third Party TAB.
- F. Separate TAB specification for the Third Party TAB contractor's scope of work shall also be prepared. This shall be used by the CF PM to hire the Third Party TAB firm.
- G. Third Party TAB scope shall be revised to include TAB of all water systems, including plumbing.
- H. Pressure critical spaces (including but not limited to OR's , Procedure Rooms and Cath Labs) shall have a series of blower door air pressure tests at the following project milestones:
 - 1. At beginning of design to determine if the project needs to include scope to make the space air-tight
 - 2. Prior to ceiling installation to shows room has met acceptable level of tightness before substantial completion is granted. This shall occur late enough in construction that the test can be successfully completed but early enough that corrections can be made without impacting project schedule.
 - 3. During Test and Balance (prior to substantial completion being granted). This requirement shall be met before project status can change to substantially complete.

20 10 82 REFERENCES

- A. National Standards for Total System Balance, by the Associated Air Balance Council (AABC), latest edition.
- B. Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems, by the National Environmental Balancing Bureau (NEBB), latest edition.
- C. 2019 Application Handbook, Chapter 39, Testing, Adjusting and Balancing by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

20 10 83 WORK INCLUDED

- A. Testing and adjusting each terminal unit air flow rate and/or airflow rate to achieve design flows and capacities.
- B. Testing and adjusting each exhaust fan to achieve design airflow rate as scheduled.
- C. Testing and adjusting each air device to achieve design airflow rate as indicated on the plans.
- D. Testing and adjusting the systems to maintain pressure relationships as follows: lab spaces as negative relative to adjacent spaces. Note this will require repeated balancing of all system to obtain the pressure relationships.
- E. Furnishing and/or installing fixed sheaves for all fans.
- F. Provide sufficient labor and resources required to assist in the commissioning process, refer to commissioning specification section.

20 10 84 SUBMITTALS

- A. The Contractor shall submit to the Architect/Engineer for approval the following within thirty (30) days of his notice to proceed:
 - 1. Name and address of the proposed Balancing Contractor and their credentials.
 - 2. Name of the Mechanical Contractor's representative responsible for the balancing work.
 - 3. The Contractor shall certify that each system is installed in accordance with the Project Documents, is operable and is prepared for testing and balancing; and that products and systems meet or exceed specified requirements.
- B. The Contractor shall submit the following prior to commencing any testing, adjusting and balancing work:
 - 1. Name of Balancing Contractor's representative for coordination with the Mechanical Contractor.
 - 2. The Contractor shall certify that: all instruments, measuring devices, meters, etc. to be used for his Work have been calibrated to NIST standards including Mechanical Contractor provided permanently installed and portable devices; that supervisor is certified by a recognized national organization; and that personnel are qualified technicians.
 - 3. At least 60 days prior to the beginning of testing the work, the Contractor shall submit to the Architect/Engineer for approval:
 - a. Written proposed procedures of testing, adjusting, balancing and documentation including techniques, methods and responsibilities.
 - b. List of each instrument to be used and latest date and method of calibration to verify accuracy. If more than one (1) year old or accuracy is in question, instrument shall be recalibrated.
 - c. Sample forms for all pieces of equipment to be tested.

20 10 85 RESPONSIBILITIES AND COORDINATION

- A. Work by Contractor, which installed the respective system to be tested, shall include the following:
 - 1. Schedule, coordinate and sequence the testing, adjusting and balancing of the respective systems. Prepare and distribute a schedule.

2. Verify that the respective equipment, ductwork, piping and temperature control systems have been provided, each is operable and apparently functioning all in accordance with and to the intent of the Project Documents. In particular, the following shall be checked and noted as having been accomplished prior to the testing, adjusting and balancing:
 - Initial checkout and start-up of all equipment.
 - Pressure and leak testing, and cleaning of all systems.
 - Alignment and adjustment of motor drives, and lubrication of bearings.
 - All dampers, manual line valves, control valves and balancing valves are in the "open" position.
 3. Verify that all instruments, measuring devices, meters, immersion wells, taps, valves, specialties, dampers, measuring and sensing elements, access openings, etc. have been provided in correct quantities and locations to permit commencement of the testing, adjusting and balancing of the Work. Correct deficiencies and/or modify the Work, as required.
 4. Provide the Balancing Contractor with all pertinent shop drawings on equipment to be tested, adjusted and balanced.
 5. Provide the Balancing Contractor with a set of "as-built" drawings or the Mechanical Contractor's marked-up "record" set showing all changes to the mechanical systems.
- B. Work by Balancing Contractor shall include the following:
1. Perform a total system balance in accordance with NEBB or AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
 2. Direct measurement of temperatures, pressures, air and fluid quantitative flow rates and any other values necessary to establish the status of each system in comparison with the Project Documents.
 3. Adjust components and devices to achieve design operating conditions within acceptable tolerances for each system. Do not use shut-off devices for balancing unless indexed. Lock memory stops or mark set points of balancing devices. Replace all system components removed temporarily during the testing and balancing effort, set all temperature controls properly and generally leave the systems in working order and "as-new" condition.
 4. Report to the Architect/Engineer any existing installed or operating condition that deviates from the design or intent of the Project Documents, and that the Balancing Subcontractor believes to be beyond the scope of his work.
 5. Furnish fixed sheaves to the Owner, upon acceptance of the balancing report, for fans furnished with adjustable sheaves where the balancing contractor was able to make the required speed adjustments with the factory sheave.
 6. Furnish and install fixed sheaves for fans furnished with adjustable sheaves where a speed change, beyond that obtainable with the adjustable sheave, is required to obtain design airflow. The system shall be proportionally balanced, then the required fan speed shall be calculated based upon the fan laws. Contractor shall also calculate the required brake horsepower at the design airflow, if this exceeds the nameplate horsepower the Architect/Engineer shall be notified.
 7. Furnish and install fixed sheaves for fans furnished with fixed sheaves where a speed change is required to obtain design airflow. The system shall be proportionally balanced, then the required fan speed shall be calculated based upon the fan laws. Contractor shall also calculate the required brake horsepower at the design airflow, if this exceeds the nameplate horsepower the Architect/Engineer shall be notified.

20 10 86 REPORTS

- A. Reports shall be submitted in 9" x 12" binder complete with cover identification, index page, and indexing tabs. Reports shall not contain footnotes explaining why the system was not balanced to the required performance.
- B. The form of the testing and the report shall be submitted and approved prior to testing work. Reports shall be submitted on pre-approved forms.
- C. Diagrams, as required, to clarify locations of measurements and/or reading shall be included in the report.
- D. Final acceptance and payment of the contract shall not be issued before final report is approved.
- E. Air Outlet forms shall contain the following minimum information:
 - Area Served.
 - Grille Type.
 - Grille Size.
 - Design, Preliminary and Final CFM.
 - Damper Position (degrees 90° open - 0° closed).
- F. Exhaust fan forms shall contain the following minimum information:
 - Unit Name.
 - Make/Model.
 - Type/Size.
 - Serial Number.
 - Fan Arrangement/Class/Rotation
 - Discharge Location.
 - Sheave Make and No.
 - Sheave Diameter and Bore.
 - No. Belts/Make/Size.
 - Motor Make/Frame.
 - Motor Horsepower.
 - Motor Volts/Phase/Amps.
 - Motor Full Load Amps/S.F.
 - Motor Sheave Make and No.
 - Motor Sheave Diameter and Bore.
 - Sheave Centerline Distance.
 - Design and Actual CFM.
 - Design and Actual Total S.P.
 - Design and Actual Fan RPM.
 - Design and Actual Motor Volts (each phase).
 - Design and Actual Motor Amps (each phase).
 - Design and Actual Discharge S.P.
 - Design and Actual Suction S.P.

20 10 87 PROCEDURES

- A. The procedures listed herein are presented to enhance the procedures of the referenced agencies and the lack of a procedure being presented herein does not relieve the Contractor from following the procedures of the referenced agencies.

- B. In general, balancing dampers shall not be used to adjust the cfm quantity of fans but rather only to adjust the proportion of the airflow within the system. The fan speed shall be adjusted, with all of the dampers open, to a cfm slightly greater than design cfm. Then the dampers shall be adjusted to move more air towards the end of the system. The balancing damper at the furthest points of the system should be nearly full open. If these furthest dampers are not open then the fan speed shall be reduced and the process repeated until a satisfactory result is achieved.
- C. Prior to testing and adjusting VAV boxes the Balancing Contractor shall verify that the controllers are functioning properly and with the proper sequence of operation. If any inadequacies are encountered they shall be reported for correction prior to testing and adjusting.
- D. When the Contractor has any questions regarding how the systems operate or cannot obtain design performance, they should contact the Engineer for clarifications or further instruction. The work shall not be considered complete until all systems and components achieve design performance unless the Engineer issues written direction otherwise.
- E. All systems shall be adjusted between 10% above the design value as a maximum, to the design value as a minimum.

20 10 90 BASIC MECHANICAL METHODS - IDENTIFICATION

20 10 91 GENERAL

- A. This Sub-section specifies basic materials and methods for identification that shall apply to systems specified in other sections of Divisions 20 - 25 of the Specifications.
- B. The Contractor shall submit schedules and listings of Work to be identified indicating color code, material, name plate information and method of application for approval prior to performing the Work.

20 10 92 REFERENCES

- A. All provisions and conditions cited in this Sub-section shall apply to Work of all other sections of Divisions 20 - 25 of these Specifications, where and when relevant.
- B. Applicable requirements of the current and accepted edition of the following codes and standards shall apply to the Work of this Sub-section:
 1. ANSI/ASME A 13.1 - "Scheme for the Identification of Piping Systems".

20 10 93 WORK INCLUDED

- A. Each respective Contractor and Subcontractor shall identify the applicable components of his Work in accordance with specifications hereinafter enumerated or where required by other sections of Divisions 20 - 29 of the Specifications.
 1. All equipment items (i.e., ERU, fans, etc.).
 2. All chilled water, heating water valves.
 3. All piping systems identifying the system type and direction of flow.
 4. All control devices and panels.

20 10 94 SUBMITTALS

- A. Contractor shall submit shop drawings for approval in accordance with Section 20 00 43 submittals.
- B. Provide an Identification Product Schedule consisting of the following minimum information:
 - Material - type of identification product.
 - System - indicate which system or equipment materials will be used for.
 - Manufacturer - Manufacturer's name, product name and model numbers.
 - Accessories - Miscellaneous materials used in affixing identification.
- C. Provide manufacturer's technical product sheet and recommended installation instructions.
- D. Provide color list/schedule and lettering sizes for pipe markers, valve tags, and equipment nameplates.
- E. Provide a valve tag list for approval prior to ordering or making valve tags.

20 10 95 GENERAL METHODS FOR IDENTIFICATION

- A. All surfaces to receive identification nameplates or markers shall be clean, degreased, dry, free of oxidation and prepared per manufacturer's recommendations.
- B. Plastic nameplates shall be installed with corrosion-resistant mechanical fasteners. Do not use adhesives.
- C. Tags shall be installed with corrosion-resistant chain and end fasteners.
- D. Pipe and duct markers shall be installed in accordance with the manufacturer's recommendations.
- E. Valve tag list for each separate trade i.e., mechanical, temperature control shall each provide a valve tag list in electronic format or under glass in a suitable frame located in a location approved by Architect/Engineer.
- E. Valve tag information is required on "as-built" drawing submittals.
- G. Acceptable Manufacturers:
 - Products of the following manufacturers may be considered
 - 1. Seton Nameplate Corp.
 - 2. Brady Signmark Division
 - 3. Craftmark Identification Systems
 - 4. D & G Sign and Label

20 10 96 PIPING IDENTIFICATION

- A. All piping, bare pipe or insulated, exposed or concealed, shall be identified by one of the methods specified herein.
- B. Markers shall be installed in clear view; aligned with axis of pipe; located at not more than twenty-five foot (25') intervals on straight runs, risers and drops; located adjacent to each valve, control device and tee fitting; and located on each side of penetrations of the building structure and non-accessible enclosures.
- C. The following schedule shall govern label types for each application:

<u>Location</u>	<u>Type</u>
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Mechanical Rooms	II
Above Lay-in Ceilings	I

1. Pressure Sensitive Tape (Type I): Vinyl pressure sensitive tape color coded and lettered in accordance with ANSI A13.1 for label of service. Flow direction shall be separately labeled with 2" wide pressure sensitive tape. The flow arrow band shall overlap the service label to secure it in place and shall not be less than two complete wraps around the pipe.
2. Plastic Pipe Markers (Type II): Manufactured in accordance with ANSI A13.1 requirements, semi-rigid plastic, pre-formed to fit curvature of pipe or pipe insulation, color coded and imprinted with media identification and flow direction. Available in varied sizes for pipe diameter, wording and inclusion of arrow.

D. The following legend, color, and lettering shall be used:

<u>Service and Legend</u>	<u>Color of Field</u>	<u>Letters</u>
<u>Materials Inherently Hazardous:</u>		
Hot Water Supply	Yellow	Black
Hot Water Return	Yellow	Black
Waste	Black	White
Vent	Black	White
<u>Materials of Inherently Low Hazard:</u>		
Chilled Water Supply	Green	White
Chilled Water Return	Green	White
<u>Fire Quenching Materials:</u>		
Sprinkler – Fire	Red	White

20 10 97 VALVE IDENTIFICATION

- A. All valves exposed or concealed shall be identified with brass valve tags indicating the service of system the valve is in and the number of the valve.
- B. Valve tags shall be minimum 1-1/2" diameter brass stock with 1/4" legend identifying and 1/2" valve number both shall be black enamel filled. Legends shall be HVAC, PLBG, SPR, and GAS.
- C. Valve tags shall be secured in place with a No. 6 brass bead chain or No. 16 brass jack chain. Chains shall be attached to the valve lever handle or around the valve stem.
- D. An additional 10 consecutively numbered tags for each service shall be provided to the Owner for future use.
- E. Balance valves that are not used as a combination balance/service valve are not required to be labeled.
- F. Temperature control valves shall be identified with a 1/4" "T.C." legend and shall be numbered consecutively starting with major equipment and then terminal units (i.e., AHU-1 preheat, cooling, reheat control valves shall be numbered 1, 2, 3 respectively).

20 10 98 EQUIPMENT IDENTIFICATION

- A. All major equipment items (i.e., chillers, air handling units, fans, terminal units, pumps, boilers, etc.) shall be identified with appropriately sized nameplates permanently attached to the respective equipment.
- B. Small equipment items (i.e., in-line pumps, pot feeders, etc.) shall be identified with brass valve tags, see requirements for valve tags and chains.
- C. Equipment that is controlled by the Building Automation Control System shall be labeled with a 2" x 5" yellow label with black letters:
"CAUTION – THIS EQUIPMENT IS UNDER COMPUTER CONTROL AND MAY CYCLE AT ANY TIME."
- D. Interior equipment nameplates shall be 1/16" thick two-ply acrylic plastic 2-1/2" x 1" size minimum with white letters on a black background. Tag size shall be appropriate for equipment name, letters shall be a minimum of 1/2" high.
- E. Exterior equipment shall be identified with nameplates suitable for exterior use or shall be engraved aluminum plates .020" thick, minimum size shall be 4" x 1-1/2" plates.
- E. Nameplates shall be attached with corrosion-resistant No. 3 round head or No. 4 sheetmetal screws.

20 10 99 DUCTWORK IDENTIFICATION

- A. Supply, return and exhaust ductwork uninsulated or insulated, exposed or concealed, shall be identified as specified herein, except for exposed ductwork in finished areas.
- B. Markers shall be installed in clear view; installed on both sides of the duct; run parallel to the ductwork; located at not more than twenty-five foot (25') intervals on straight runs at all branch locations; and located on each side of penetrations of the building structure and non-accessible enclosures.
- C. Markers shall be pressure sensitive vinyl tape labeled for service and direction of airflow. Minimum size shall be 2" high x 8" long.
- D. Supply, return, exhaust and outdoor air ductwork labels shall be blue with white letters. Hazardous exhaust air ductwork labels shall be yellow. Outdoor air labels shall have an "air" legend.

20 10 100 CONTROL DEVICES IDENTIFICATION

- A. The materials specified herein Section 20 10 90 shall apply to Division 25 Temperature Control Systems. Additional identification work is specified in Division 25.

20 20 10 ELECTRICAL REQUIREMENTS

20 20 11 GENERAL

- A. This Subsection specifies the basic requirements for electrical components which are an integral part of "packaged" mechanical equipment. These components include, but are not limited to, factory installed motors, starters, disconnect switches, control panels and related prewiring of power and control wiring for a single external electrical service connection. All material and equipment shall be provided for the application and service intended.

- B. Specific electrical requirements (e.g. horsepower, electric characteristics, etc.) for mechanical equipment shall be specified within the respective equipment specifications or shall be scheduled on the Plans.
- C. The Contractor shall verify that electrical characteristics of material and equipment furnished for Divisions 20 - 25 equipment are in accordance with the electric service and comply with the specifications and requirements of Division 26 - 29.
- D. Unless otherwise specified as an integral part of packaged mechanical equipment, motor control centers, motor starters and disconnect switches and the power wiring from power source to motor starting equipment (including variable frequency drive packages) and wiring from that equipment to the respective motors including final connections shall be performed as Electrical Work of Division 26 - 29.
- E. The field installation of electrical components, not included in Division 26 - 29, that are specified to be provided with the mechanical equipment and are shipped separately shall be the responsibility of the Contractor furnishing the base equipment.
- F. All electrical components and material shall be UL labeled.
- G. Submittals for the applicable electrical equipment shall include the following: identification of the equipment which the electrical material is to serve, application, voltage, phases, full load amperage, wattage and NEMA enclosure. For motors: horsepower, RPM, full load power factor and efficiency, frame size and service factor.
- H. Identification of electrical components of mechanical equipment shall be in accordance with Subsection 20 10 90, "Basic Mechanical Methods - Identification".

20 20 12 REFERENCES

- A. Electrical material and equipment provided for Divisions 20 - 29 shall meet the applicable requirements of the latest accepted edition of the following codes and standards:

ANSI	American National Standards Institute
EI	Edison Electrical Institute
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriter's Laboratories, Inc.

20 20 13 MOTORS

- A. The following are basic minimum requirements for all motors. Additional motors, more detailed and specific requirements may be specified with the respective equipment.
- B. Single-phase motors shall be provided for all motors 1/2 HP or less, except as specified or scheduled otherwise and shall be of the permanent split capacitor (PSC) type.
- C. Polyphase motors shall be provided for all motors 3/4 HP or larger, except as specified or scheduled otherwise with a minimum power factor of .85 at 65% of full load or shall be power factor corrected.
- D. Multi-speed motors shall have dual windings wound to the speeds scheduled or specified.
- E. Torque characteristics shall be sufficient to satisfactorily accelerate the driven load(s) with low in rush current.

- F. Motor horsepower sizes shall be large enough so that the driven load shall not require the motor to operate in the service factor range.
- G. Temperature rating: Rated for 40 deg. C environment with maximum temperature rise for continuous duty at full load of 40°C for open dripproof motors, 50°C for splash proof motors, and 55°C for totally enclosed motors (Class B insulation). Motors used with variable frequency drives/inverters shall be NEMA MG1, Part 31 Compliant and have a Class B temperature rise with Class F insulation design to resist transient spikes, high frequencies, and short rise time pulses produced by inverters.
- H. Starting capability: Frequency of starts as specified by the automatic control system. For manually controlled motors, not less than five (5) evenly time spaced starts per hour.
- I. Service factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- J. Motor construction:
 - 1. NEMA standard frame sizes, general-purpose open dripproof (unless otherwise specified), continuous duty, Design "B" (unless "C" is required for high starting torque). Motor frame, end bells and conduit box shall be cast iron; stator windings shall be copper. Aluminum is unacceptable for any parts. Provide grounding lug in motor terminal box.
 - 2. Motors located outdoors or otherwise exposed to water, dust, etc where an open motor would not be suited, shall be totally enclosed fan-cooled (TEFC).
 - 3. Bearings: Ball or roller bearings with inner and outer shaft seals. Externally accessible inlet/outlet grease fittings. Where motors are enclosed within equipment, extend grease tubing to exterior of the enclosure. Bearings designed to resist thrust loading for drives producing lateral or axial thrust. Fractional horsepower, light duty motors may have sleeve bearings.
 - 4. Overload protection: Built-in thermal overload protection.
 - 5. Noise rating: Motors shall meet IEEE, Standard 85.
 - 6. Efficiency: Motors shall be NEMA Premium Efficiency per NEMA Standards Publication MG 1-2003, Table 12-12 and 12-13.
 - 7. Nameplate: Indicate full identification of manufacturer's name, model number, serial number, horsepower, speed, voltage, characteristics, construction, special features, etc. Nameplates in harsh environments such as for cooling towers, or in pool equipment rooms, etc. shall be suited to the specific application.
- K. Acceptable manufacturers: Baldor, General Electric, Gould, Marathon, Magnetek, Reliance, Siemens, Toshiba, and U.S. motors.

20 20 14 MOTOR CONTROLS

- A. Motor Starters: NEMA 1, general-purpose enclosures with padlock ears, unless specified other wise. Type, size and duty shall be as specified or as recommended by the motor manufacturer and the requirements of the driven equipment for applicable protection and start-up conditions.
- B. Manual Starters: Pilot light and extra positions for multi-speed motors. Melting alloy type thermal overload relay protection.
- C. Magnetic Starters: Hand-off-Auto selector switches, pilot lights, interlock contacts, switches and other devices as required for control requirements. Trip-free thermal overload relays for each phase. Built-in 120 volt control circuit transformer, fused from line side, where power service exceeds 240 volts. Externally operated manual reset; under-voltage release of protection.

D. Acceptable Manufacturers: Allen-Bradley, Cutler-Hammer, General Electric, Square D.

20 20 15 DISCONNECT SWITCHES

- A. Fusible: For 3/4 horsepower and larger. Disconnect switch shall be horsepower rated, heavy duty, spring reinforced fuse clips each phase, quick-make/quick-break mechanism with arc quenchers, dead front line side shield, solderless lugs, silver electroplated current carrying parts, lockable hinged door, capacity and electric characteristics as specified.
- B. Non-fusible: For 1/2 horsepower motor and smaller. Disconnect switch shall be horsepower rated, toggle switch type, quantity of poles and voltage rating as specified.

20 20 16 MULTI-SPEED MOTORS AND CONTROLS

- A. Multi-speed motors, when required, shall be specified under the heading of the respective equipment to be driven.
- B. Motor controls for multi-speed applications shall be specified, also, under the heading of the respective equipment, if said equipment is a “packaged” type unit.
- C. Otherwise, multi-speed motor controls shall be specified in Division 26.

20 20 17 VARIABLE SPEED DRIVES

- A. Motor controls for variable speed drives shall be specified under the heading of the respective equipment, if said equipment is a “packaged” type unit.
- B. Otherwise, variable speed drives shall be specified in Division 26.

20 20 18 CONTROL PANEL

- A. NEMA 1 general-purpose enclosure for indoor application; NEMA 3R weather resistant enclosure for exterior location.
- B. Factory mount panel(s) and internal power and control devices. Pre-wire all devices for the operation of the related equipment so that only one main power connection shall be required in the field.
- C. Provide internal protection for each circuit, maximum 120-volt secondary control transformer(s), terminal strips for wiring terminations, identification of components and wiring diagram inside the cover.

20 20 20 DRIVES AND GUARDS

20 20 21 GENERAL

- A. This Subsection covers V-belt, sprocket-chain, gear and direct coupled drives.
- B. All drives shall be selected for 150% of specified motor nameplate horsepower.
- C. All drives shall be installed, balanced and aligned in accordance with the respective manufacturer's instructions and recommendations.

20 20 22 DIRECT DRIVES

- A. Wherever available, motors and related direct driven equipment shall be mounted on a common base.

20 20 23 GUARDS

- A. All belts, chains, pulleys, shafts, sheaves, sprockets, gears, couplings, projecting setscrews, keys and any other rotating parts shall be provided with guards by the Contractor furnishing the base equipment.
- B. Guards shall be designed and arranged in accordance with OSHA requirements.
- C. Guards shall completely enclose the drive, shall be secured to the respective equipment and shall be removable for servicing. Wherever available from the manufacturer, guards shall be provided with the equipment. If not, these shall be field fabricated.
- D. Provide reinforced openings with removable coverplates for access to motor and driven shafts for speed measurement.
- E. Extend tubing for grease fittings inside the guard to accessible locations outside the guard.

20 20 24 INSTALLATION AND OPERATION

- A. Install, balance and align all drives in accordance with the respective manufacturer's instructions and recommendations.
- B. The balancing and alignment of drives including pinning, doweling and grouting shall be the responsibility of the Contractor furnishing the equipment. Any adversities arising from executing the Work shall be resolved/remedied by the Contractor.
- C. Verify all electrical characteristics prior to running electric motor driven equipment. Check motor amperage draw and rotation for proper operation.

END OF SECTION

20 25 00 INSULATION

20 25 01 GENERAL

- A. This Section specifies mechanical insulation of piping, equipment and ductwork.
- B. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.
- C. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

20 25 02 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:
 - 1. State and local Air Pollution Codes and Regulations.
 - 2. NFPA 255/UL 723/ASTM E-84 Surface Burning Characteristics of Building Materials.
 - 3. UL 1479/ASTM E-814 Fire Test of Through-Penetration Firestops.

20 25 03 RELATED SECTIONS OF THE SPECIFICATIONS

- A. Requirements of the following Sections of the Specifications apply to Work for this Section:
 - .1 Division 20 - Basic Mechanical Conditions
 - .2 Division 20 - Basic Mechanical Materials and Methods
 - .3 Division 22 - Plumbing Work
 - .4 Division 23 - HVAC Piping and Equipment
 - .5 Division 24 - Air Distribution

20 25 04 DEFINITIONS

- A. The term “**fitting**” where used in this Section of the Specifications shall be construed as an elbow, tee or reducer. Unions, flanges and valves shall not be considered as fittings.
- B. The term “**cold**” shall be defined as the temperature of a surface that may result in the formation of condensation.
- C. The term “**accessory**” shall include staples, bands, wire, mesh, clips, pins, studs, tape, anchors, corner angles, cements, adhesives, coatings, sealers, mastics, finishes, etc.
- D. The term “**ASJ**” where used in this Section of the Specifications shall mean a reinforced vapor retarding All Service Jacket.
- E. The term “**SSL**” where used in this Section of the Specifications shall mean Self-sealing Lap Joint closure system for longitudinal jacket joints.
- F. The term “**supply air**” where used in this Section of the Specifications shall mean downstream of a coil.
- G. The term “**outdoor air**” where used in this Section of the Specifications shall mean ambient air that has not been conditioned.
- H. The term “**return air**” where used in this Section of the Specifications shall mean conditioned air that is returned from the space.

- I. The term “**mixed air**” where used in this Section of the Specifications shall mean air streams that are a mixture of “outdoor air” and “return air”.
- J. The term “**relief air**” where used in this Section of the Specifications shall mean excess return air that is relieved from the building.
- K. The term “**exhaust air**” where used in this Section of the Specifications shall mean air that is removed due to contaminates, odors, or heat.

20 25 05 WORK INCLUDED

- A. Furnish material, labor and services necessary for and incidental to the insulation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the Specifications (Subsection 20 25 03) to perform the Work completely.
 - 1. Chilled water piping
 - 2. Heating water piping.
 - 3. Condensate drain piping.
 - 4. Waste piping and floor drains located above grade serving condensate drains.
 - 5. Ductwork/sheetmetal systems.
 - 6. Laboratory vent piping.
- B. Providing appropriate size calcium silicate/cellular glass/pipe shield manufactured inserts to the trade contractor for installation between the pipes and oversized hangers as specified in this section.
- C. Fire wrapping piping system located in occupied spaces or plenum spaces that do not meet flame spread 25 and smoke development 50.

20 25 06 SUBMITTALS

- A. The Contractor shall submit shop drawings for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.
- B. Provide an INSULATION PRODUCT SCHEDULE consisting of the following minimum information:
 - Material - type of insulation material, jackets, or covers.
 - Manufacturer - manufacturers name, product name, and K-value where applicable.
 - Accessories - tapes, staples, coatings, adhesives including manufacturer's name and product name.
 - Systems - indicate systems where product is used.
- C. Provide an INSULATION THICKNESS SCHEDULE consisting of the following minimum information:
 - System - indicate which system insulation is installed.
 - Location - inside, outside, concealed, exposed, etc.
 - Size - indicate size range of pipe, insulation type used.
 - Thickness - indicate insulation thickness in inches.
- D. Provide manufacturer's technical product data of each material and accessory item with engineering support information and recommended installation procedure. Indicate product number, “K” value, thickness and required accessories for each application.

- E. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

20 25 07 SPECIAL REQUIREMENTS

- A. Contractor's Qualifications: Contracting company shall be one specializing in insulation application and have a minimum of three (3) years experience in this work.

20 25 10 INSULATION MATERIALS

20 25 11 GENERAL

- A. Materials and accessories furnished for this Section of the Specifications shall be standard cataloged products, new, commercially available and suitable for the service specified.
- B. Insulation material and/or accessories containing asbestos are prohibited.

20 25 12 FIRE SAFETY STANDARDS

- A. All insulation material shall have composite fire and smoke hazard ratings in accordance with NFPA 255 and UL 723 not exceeding the following values as tested by the latest procedures of ASTM E-84: flame spread of 25; smoke developed of 50.
- B. Accessories such as adhesives, mastics, cements, tapes and cloths for seams, joints and fittings shall have the same ratings as hereinbefore listed. All products and their respective shipping cartons shall have indications that flame and smoke ratings meet the aforementioned requirements. Any treatment of jackets or facings to impart acceptable flame and smoke safety values shall be permanent; water-soluble applications are prohibited. The Insulation Contractor shall bear responsibility that all products to be used meet the foregoing criteria.

20 25 13 TYPES OF INSULATION MATERIALS

The following types of insulation material are enumerated in the respective INSULATION MATERIAL SCHEDULE. K values listed are in units of (Btu in/hr ft.2 °F) and are based on specific products and are to be met or exceed. ANSI/ASTM types or class shall not provide relief for any K value specified.

- A. Type CS: Hydrous calcium silicate, molded pipe or block form, asbestos free, ANSI/ASTM C533, Type I, "k" value of 0.41 at 200 degrees F for pipe, "k" value of 0.39 at 200 degrees F for block, density of 15#/cubic foot. Owens-Corning Calcium Silicate or equivalent by Knauf, Manville or Pabco.
- B. Type GF1: Glass fiber, non-combustible, preformed for pipe and tube application, ANSI/ASTM C547, Class 1, "k" value of 0.23 at 75 degrees F. Owens-Corning type ASJ with SSL-II vapor retarder jacket or equivalent by CertainTeed, Knauf, Manville or Schuller.
- C. Type GF2: Glass fiber, non-combustible, rigid board with vapor retarder facing, ANSI/ASTM C612, "k" value of 0.24 at 75 degrees F, density of 3#/cubic foot. Owens-Corning type 703 with ASJ 25 jacket or equivalent by CertainTeed, Knauf, Manville or Schuller.
- D. Type GF3: Glass fiber, flexible blanket, laminated to reinforced kraft vapor retarder facing, ANSI/ASTM C553, Type II, "k" value of 0.27 at 75 degrees F, density of 1#/cubic foot. Owens-Corning type 100 All-Service faced duct wrap or equivalent by CertainTeed, Knauf, Manville or Schuller.

- E. Type F1: Flexible elastomeric foamplastic with smooth exterior surface, preformed for pipe and tube application, ASTM C534, Type I, “k” value of 0.28 at 75 deg. F. Armstrong AP Armaflex pipe insulation, K-Flex LS tube, Aerocel EDPM tube.
- E. Type F2: Flexible elastomeric foamplastic with smooth exterior surface, sheet material, ASTM C534, type II, “k” value of 0.28 at 75 degrees F. Armstrong AP Armaflex sheet material, K-Flex LS sheet, Aerocel EDPM sheet.
- G. Type FG: Rigid foamglass preformed for pipe applications ASTM C552, K value of 0.33 at 75°F with all-purpose vapor retarder jacket. Pittsburgh Corning Foamglass.
- H. Type PI: Polyisocyanurate preformed for pipe applications ASTM C591, aged “k” value of 0.19 at 75 degrees F, density of 2#/cubic foot. Shall be ASTM E84 less than 25/50 rated. Saran 560 vapor barrier.
- I. Type PH: Phenolic preformed for pipe applications ASTM C1126, Type III, grade 1. ASTM E84 less than 25/50 rated, Saran 560 vapor varrier, 0.15@75°F.

20 25 14 TYPES OF PIPING JACKET MATERIALS

- A. .0016” aluminum or 0.010” stainless steel jackets with moisture barrier shall be cut and fitted to size required. Fold a ½” safety edge on exposed side, roll to diameter required and secure with ½” x 0.020” aluminum or ½” x 0.015” stainless steel bands respectively on 9” centers (4 bands per 3 foot section of jacketing). Provide appropriate seals, and shed water toward low end of pitched piping. Install lap on top quadrant (2 or 10 o'clock position) of outside diameter of insulation and line up bands and seals to present neat and workmanlike appearance. Fitting covers shall be consistent with piping insulation jacketing. Secure in place with SS screws or banding. Seal with approved caulking. Sharp edges shall be turned under or otherwise protected.
- B. PVC jacketing 0.030” thick for pipe insulation and PVC fitting covers shall be applied over the insulation and vapor barrier system where indicated below for aesthetics or mild abuse areas.
- C. Finish piping insulation with factory or field application for respective locations as follows:

Dry, low abuse: (indoor)	Concealed, not exposed to view. Mechanical equipment room. Exposed, finish space.
Pipe: Fittings:	ASJ jacket. Pre-molded PVC covers.
High abuse area:	Exposed vertical risers in all Storage Rooms, Janitor Closets. Exposed, unfinished space.
Pipe:	Stainless steel jacket with seam away from abusive force. Apply to height of 8 feet.
Fittings:	Formed stainless steel covers.

20 25 15 DELIVERY AND STORAGE OF MATERIALS

- A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.
- C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance and provide the Architect/Engineer with a copy of manufacturer's recommendation for approval.

20 25 16 ACCEPTABLE MANUFACTURERS

The following are acceptable manufacturers for products specified in this section of the specification.

- A. Metal jackets:
 - 1. Childers Products Co., Inc.
 - 2. Insul-Coustics
 - 3. Pabco Surfit Metal Corp.
 - 4. RPR Products, Inc.
- B. PVC covers:
 - 1. Proto Corp.
 - 2. Ceelco Corp.
 - 3. Speedline PVC Corp.
- C. Adhesives and Coatings:
 - 1. Alpha Associates
 - 2. Miracle Adhesives
 - 3. Vimasco Corporation
- D. Fasteners
 - 1. ACS Industries
 - 2. GEMCO
 - 3. Midwest Fasteners
- E. Fire Stop
 - 1. 3M
 - 2. Metacaulk

3. Specified Technologies, Inc.
4. USG Interior, Inc.

20 25 20 INSULATION MATERIAL SCHEDULES: <SEE FOLLOWING PAGES>

20 25 21 INSULATION MATERIAL SCHEDULE I-1

A.	Service: Hot and cold piping	<u>thickness</u>	<u>insulation material</u>
B.	Chilled water supply and return piping 2" and smaller	3/4"	Type PI*, PH, F1
C.	Hot water (141°F – 200°F) supply and return 1-1/4" and smaller	1-1/2"	Type GF1, F1
D.	Condensate Drain Lines:	1/2"	Type F1
	All - except air handling units in Mechanical Rooms where drain line is 2'-0" or less in total length and located at the Mechanical Room floor.		
E.	Waste Piping and Floor Drains:	1/2"	Type F1
	Piping above grade serving floor drains, hub drains, indirect cabinets, etc., that receive condensate from cooling coils. Insulate piping to where it connects to main waste pipe.		
S.	Fittings (hot and cold):	Molded/preformed fittings, secured in place with twine or tape, seal all "cold" applications prior to installing jacket material.	
T.	Unions, flanges: Valves: (cold piping)	Type F1, same thickness as adjacent piping. Form external collar, minimum 1" overlap on adjacent insulation. Use adhesive to secure in place and maintain vapor barrier.	
U.	Unions, flanges: (hot piping)	No insulation.	
V.	Valves (hot piping):	Insulate valve body only.	
W.	Joints:	Lines subject to condensation: seal longitudinal laps of jacket with adhesive and wrap butt joints between sections with 2" wide tape.	

20 25 22 INSULATION MATERIAL SCHEDULE I-2

A. Service: Ductwork, 0 to 250 degrees F.

Location

Thickness

B. All Locations

1. Exhaust Air For Energy Recovery 2"

E. Insulation Material

1. Rectangular ducts Type GF2

2. Round and Oval Ducts Type GF3

20 25 30 INSULATION APPLICATION

20 25 31 INSULATION APPLICATION - GENERAL

- A. Respective piping system, duct system shall be pressure tested, proved tight and accepted, as specified in section for installation of such, before insulation is applied. Sheet metal ductwork joints shall be sealed prior to insulating. Coordination among the respective contractors is essential.
- B. Insulation materials and accessories shall be applied in accordance with respective manufacturer's recommendations and recognized industry practice for the insulation to serve its intended purpose. All surfaces to receive insulation shall be clean, dry, free of oxidation and prepared as required.
- C. The insulation work shall be subject to inspection during the various applications and construction phases. Material, accessories, finishes, methods and workmanship that are not in compliance with these Specifications and/or approved submittals may lead to rejection of the Work and replacement at the Contractor's expense.
- D. Tie-ins to existing systems and all new work shall be insulated to provide a complete and functional system. Finishes shall be compatible wherever possible.
 - 1. When existing insulation thickness is different than the specified thickness herein, the Contractor shall notify the Architect/Engineer. It is the intent that the existing piping would be restored to its original condition (thickness and finish) as if new work had not been performed.

20 25 32 INSULATION APPLICATION - PIPING

- A. Insulate each piping section with single thickness full-length units of insulation, with a single cut piece to complete the run where a fitting is encountered. Do not use cut pieces or scraps abutting each other.
- B. Extend piping insulation without interruptions through walls, floors, and similar piping penetrations, except where otherwise specified.
- C. Insulation on unions, flanges, valves, strainers, expansion joints, pump impeller housings and other equipment requiring accessible servicing shall be removable and reusable without damage. Items requiring periodic attention shall have covers and/or casings to contain the insulation.

- D. All "cold" piping systems shall be insulated with type and thickness of material herein specified and shall have a continuous vapor retarder through all fittings, hangers, supports and sleeves.
- E. In cold systems flanges, unions, valves, etc., shall be covered with an oversized pipe insulation section sized to provide the same thickness as on the main piping section. An oversized insulation section shall be used to form a collar between two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on main piping system. Rough cut ends shall be coated with suitable weather and/or vapor resistant mastic as required by the system location and service. All valve stems must be sealed with caulking that allows free movement of the stem but provides a seal against moisture incursion.
- E. In hot system flanges, unions, valves, etc., shall be left exposed; insulation ends shall be tapered and sealed to allow bolts to be removed or other required access.
- G. The installation of cold piping systems shall use oversize (outside the thickness of the insulation) pipe hangers.
 1. Piping systems 3" and smaller, the Insulation Contractor shall replace temporary wood blocking with insulation of thickness as scheduled in this section of the specification. Metal pipe shields shall be placed between the pipe hanger and the insulation.
 2. If in the event pipe hangers are not oversized, this Contractor shall notify the Engineer and the Contractor(s) who provided and/or installed hangers. Hangers shall be corrected before pipe is insulated.
 3. Where size on size hangers have been approved by the Engineer in writing for use in special situations, the insulator shall insulate the hanger and hanger rod with ½" Type F insulation. Pipe insulation shall terminate at each side of the hanger and have vapor barrier end joint butt strips. Hanger insulation shall overlap pipe insulation a minimum of 4" on each side of the hanger and secured to the pipe insulation with contact adhesive. Hanger rods shall be insulated for a minimum of 12" secured to the rod with contact adhesive and the end sealed with a bead of caulk.
 4. The Contractor shall adjust hangers after the insulation and pipe shields have been installed to provide an evenly supported piping system. No hanger shall bear the entire weight or not carry any weight of piping system.
- H. Special requirements for fiberglass pipe insulation:
 1. Fiberglass pipe insulation, All Service Jacket/Self Sealing Lap (ASJ w/SSL) type, shall be installed with laps positioned to shed water, position at either 10 o'clock or 2 o'clock and shall not be visible to view. End joint butt strips shall be installed on all piping with ½" adhesive to adhesive overlap.
 2. For piping systems using fiberglass insulation, the fittings shall be insulated with: double thickness molded fiberglass fittings, or preformed cellular glass fittings secured with twine or wire; or with flexible elastomeric foamplastic; at the Contractor's option. The pre-molded PVC fitting covers shall be installed over the fiberglass inserts and secured with SS tacks. Victaulic fittings or couplings shall be insulated with sheet elastomeric foam plastic insulation formed to the fitting and formed "collars" over all couplings encountered.
 3. For piping systems using fiberglass insulation, butt joints in hot piping shall be made with 2" wide vapor barrier tape over butt joints. Butt joints in cold piping shall be made with a wet coat of vapor barrier lap cement on butt joints and seal joints with 2" vapor barrier tape. All pipe insulation ends shall be tapered and sealed.
 4. On "cold" applications only, the following additional requirements shall apply: the premolded fittings shall be sealed with an approved vapor barrier retardant prior to installing

the jacket materials. Premolded PVC fitting covers shall then be installed over the premolded inserts, all joints shall be sealed with vapor barrier cement and 2" vapor barrier tape on lap joints. Premolded stainless steel or aluminum fitting covers shall be installed per the manufacturer's instructions and a bead of clear silicon caulk applied to all joints. Straight lengths of insulation abutting all fittings shall have both ends sealed with vapor barrier cement to prevent "wicking" or moisture migration. At a maximum of twenty-one foot (21') intervals, joining ends of the butt joints shall be sealed with vapor barrier cement prior to butting together to prevent "wicking" or moisture migration.

- I. For piping systems using elastomeric foamplastic insulation, joints and seams shall be sealed with manufacturer's recommended contact adhesive. Fittings shall be insulated from segments fabricated from pipe insulation or sheet material, secured and sealed with contact adhesive. Termination points and ends shall be sealed to the pipe to prevent backflow of condensation on the inside of the insulation. Any piping outdoors or otherwise exposed to UV or ozone provide two (2) coats of WB Armaflex or Rubatex 374 finish.

20 25 33 INSULATION APPLICATION - DUCTWORK

- A. Ductwork systems shall be insulated in accordance with the insulation schedules. Insulate each duct section with single thickness full length pieces. Do not use scraps abutting each other.
- B. Extend insulation without interruptions through walls, floors, and similar penetration, except where otherwise specified.
- C. "Cold" duct systems shall have insulation with a continuous vapor retarder through all fittings, hangers, supports, air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system, etc.
- D. In "cold" duct systems, using rigid board or sheet elastomeric foam insulation, support angles, stiffener angles, ductmate flanges, etc. they shall be covered with an oversized insulation strip sized to provide the same insulation thickness as on the duct. Provide a minimum of 2" of overlap on each side of the obstruction.
- E. Board insulation shall be properly cut and dry fitted to the surface to be insulated. Edges shall be neat and clean cut. No intermediate cut pieces shall be allowed on the bottom and sides of the ductwork. Insulation board shall be secured in place using mechanical fasteners such as welded pins or speed clips. Locate not less than 3" from each edge or corner and approximately 12" on centers on all sides. There shall be a minimum of two (2) rows of pins on the bottom of the duct and one (1) on the sides. Additional pins may be needed on the bottom to prevent sagging. All seams, joints, penetrations and breaks in the vapor retarder jacket shall be sealed with pressure sensitive tape matching insulation facing. Edges shall be provided with 28 ga. 1" x 1" aluminum corner beading properly secured and shall have the same facing material as the insulation board.
- F. Flexible duct wrap insulation shall be cut properly and fitted to "stretchout" dimensions and a 2" piece of insulation removed from the facing at the end of the piece to form an overlapping staple and tape flap. Insulation shall be installed with facing outside so tape flap overlaps facing at the other end. Insulation shall be butted tightly. Seams shall be stapled on 6" centers with outward clinching staples. Adjacent sections of duct wrap insulation shall be butted tightly with the 2" tape flap overlapping and stapled. For horizontal oval ducts over 30" wide, duct wrap insulation shall be secured additionally to the bottom of the duct with mechanical fasteners such as pins and speed clip washers spaced on 18" centers to prevent sagging. All seams, joints, tears, punctures and other penetrations in the vapor retarder jacket shall be sealed with FRK backing pressure sensitive tape.

- G. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation.
- H. Where a duct run changes from interior lining to exterior application (or vice versa), there shall be a 6" overlap of insulation.
- I. In "cold" duct system with internal duct insulation, with 1 1/2 " thickness flexible duct wrap, insulate air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system that are not internally insulated.

20 25 34 PVC PIPING INSULATION PLENUM FIRE WRAP

- A. Provide 1/2 inch minimum thickness fire resistant blanket wrap consisting of inorganic blanket encapsulated with a scrim-reinforced aluminum foil and overlap seam to provide a flexible, non-combustible enclosure for cables and PVC non-plenum rated pipe in return air plenums as tested to UL 910.
- B. Plenum Wrap shall be tested in accordance with the following:
 - ASTM C 411, ASTM C 518, ASTM E 84, ASTM E 136, and UL 910
 - Maximum Flame Spread (Ft.) 0.01
 - Maximum Smoke (Optical Density) 0.01
 - Average Smoke (Optical Density) 0.00
 - Surface Burning Characteristics (ASTM E 84)
- C. Cut Fire Barrier Plenum Wrap to a length sufficient to wrap completely around the perimeter of the pipe, plus provide a longitudinal overlap of not less than 1 inch and an overlap of 1 inch, minimum, over the adjacent wrap section. Use aluminum foil tape to seal cut edges of the blanket. Temporarily secure Plenum Wrap in place using 3/4 inch wide filament tape. Install minimum 1/2 inch wide by 0.015 inch (28 gauge) thick stainless steel metal banding with stainless steel metal band clamp or 16 gauge galvanized tie wire around the Plenum Wrap to hold it in place. Place the bands or tie wires 1/4 inch from each edge of the blanket and at the midpoint of the blanket, 11-3/4 in. on center. Tension the banding or tie wire to hold the Plenum Wrap snugly in place, compressing the foil but not cutting the foil.
- D. PVC Piping Insulation Plenum Fire Wrap shall be 3M Fire Barrier Plenum Wrap 5A or approved equivalent.

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21 00 00 FIRE PROTECTION SYSTEM

21 00 01 GENERAL

- A. This section specifies a hydraulically calculated fire protection system designed and installed by the Contractor as described on the drawings and hereinafter.
- B. It is the intent that the drawings and specifications shall describe and provide for a working installation complete in every detail and all items necessary for such complete installation shall be furnished whether specifically mentioned or not.
- C. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.
- D. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

21 00 02 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:
 - 1. National Fire Protection Association (NFPA) 13, 2019.
 - 2. The Local Authority having jurisdiction.

21 00 03 REFERENCES, RELATED SECTIONS OF THE SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

- A. Division 20 - Basic Mechanical Conditions.
- B. Division 20 - Basic Mechanical Materials and Methods

21 00 04 DEFINITIONS

- A. The term “**layout**” where used in this Section of the Specifications shall mean drawings prepared by the Contractor showing where all piping and heads are located. These drawings should include pipe elevations, need not include pipe sizes and should not include hydraulic calculations.
- B. The term “**Authority Having Jurisdiction**” or “**AHJ**” where used in this Section of the Specification shall mean the organization, office, or individual responsible for approving equipment, an installation, or a procedure.
- C. The term “**rhythm**” where used in this Section of the Specifications shall mean spaced in a manner which would place the heads at the same location with respect to lights or diffusers (i.e., for a row of lights spaced at 12' centers heads shall also be on 12' centers so that the heads will remain the same number of ceiling tiles or distance away from the lights; where there is an odd number of tiles between lights or diffusers, it is also preferable to have heads located at the tile centered between them).

- D. The term “**working drawings**” where used in this Section of the Specifications shall mean drawing of the quality and containing all information as which would be required for approval by local official and for field construction.

21 00 05 WORK INCLUDED

- A. Furnish material, labor and services necessary for and incidental to the installation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Subsection 21 00 03 to perform the Work completely.
- B. Furnish and install a complete hydraulically engineered extension of the building fire protection system including the relocation of existing heads on existing branch lines.
- C. Verify actual water supply with a test, preferably witnessed or performed by the local fire official.
- D. Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.

21 00 06 SUBMITTALS

- A. The Contractor shall prepare submittals for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.
- B. Submit “Layout drawings” and equipment cut sheets.
- C. Contractor shall submit “Working drawings” coordinated with the other trades for review prior to any fabrication or installation.
- D. Fire sprinkler shop drawings shall be submitted for review and approval prior to installation. The plans will be reviewed by: Maintenance Engineer/MU Fire protection shop, City of Columbia Fire Marshal and Design Engineer.

21 00 07 SPECIAL REQUIREMENTS

- A. The Contractor preparing the drawings and calculations shall be NICET Level 3 certified or a Professional Engineer licensed in the State of Missouri, whichever is required by the Authority Having Jurisdiction.
- B. All equipment shall be U.L. Listed or F.M. approved for use in fire protection systems.
- C. Where Pipe and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing lines for: sizes, direction of flow (via pressure or physical tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

21 00 08 CLOSE-OUT REQUIREMENTS

- A. Reference Section 20 00 48.
- B. Where NFPA maintenance information is utilized, it shall be edited to contain only information that is relevant to this project.

21 00 10 DESIGN

21 00 11 WATER SUPPLY

- A. The existing water supply shall continue to be used.
- B. A flow test can be obtained by requesting from the owner.
- C. This information is provided for general information only.
- D. Design water pressure requirements shall include a minimum of 10-psi safety factor. Where Authority having jurisdiction requires a higher safety factory it shall be used.
- E. The point of this Contractor's work shall start where determined by the "General Contractor" and local trade practices.

21 00 12 LAYOUT - GENERAL TO ALL SPRINKLER SYSTEMS

- A. The "layout" shall be submitted to the Architect prior to performing hydraulic calculation, sizing pipes or seeking approvals from the authority having jurisdiction.
- B. The Architect/Engineer will review "layout" for aesthetics, and pipe routings for consistency with the construction documents.
- C. Minimum head spacing shall be as per NFPA-13. additional heads may be required by the Architect/Engineer to create spacing that works with the reflected ceiling plans. Contractor shall layout any areas not shown on the plans with symmetry and "rhythm" in mind.
- D. Heads shall be on return bends and centered $\pm 1"$ for 2' x 2' ceiling tiles, or on quarter points $\pm 1"$ for 4' x 2' ceiling tiles.
- E. Contractor shall not scale the drawing, refer to architectural drawings for dimensions. Where the room dimension is at the maximum size listed for the sprinkler heads, install an additional row of sprinklers.
- F. All sets and rises shall be located above ceilings of adjacent spaces of rooms without ceilings as opposed to making the sets and risers in the exposed spaces.

21 00 13 APPROVALS

- A. Submittal drawings shall show lights, ducts, and pipes indicating all necessary rises and drops in sprinkler piping required for routing. Drawings shall be of a minimum of the same scale as the contract documents 1/8" = 1'-0" scale.
- B. The "layout" submittals shall be provided as PDF drawings of the piping layout. Equipment cut sheets shall also be provided at this time.
- C. Any pipe sizing or hydraulic calculations performed prior to the Contractor receiving the "layout" submittal with the 'approved stamp' of the Engineer shall be at the Contractor's own risk. Any design changes resulting in resizing pipe and/or revising hydraulic calculations will be done at no cost to the Owner.
- D. The "working drawing" submittals shall be provided as PDF drawings of the piping layout and include hydraulic calculations. Calculations shall include peaking information for each area calculated. The hydraulic calculation used for the system design shall be clearly identified from

all other hydraulic calculations and should show the safety factor the designed system has relevant to the available water test pressure.

- E. Hydraulic calculations shall include: actual pipe internal diameters and coefficients of materials approved in the "layout" submittal; design density; remote area size; and area per sprinkler.
- F. The Contractor shall not pursue any approvals or interpretations of the design documents except through the office of the Architect/Engineer.
- G. All work shall meet the requirements of the Owner, authority having jurisdiction, Architect and Engineer. These requirements may be greater than required by NFPA. Work shall not start prior to the Contractor receiving the "working drawing" shop drawings with the 'stamp' of the Engineer and approval from the authority having jurisdiction.

21 00 14 TESTING

- A. Preliminary testing witnessed by the Architect/Engineer shall be conducted to assure proper operation before the final test is scheduled. Prior to this testing, pipes shall be flushed, hydrostatically tested, and all valves and devices shall be operated. All requirements of "System Acceptance" of NFPA 13 shall be met in full.
- B. The sprinkler system shall be final Acceptance tested in the presence of the Owner's Representative and the governing agencies having jurisdiction for approval.

21 00 15 ACCEPTANCE

- A. .Acceptance test performed as described above.
- B. Contractor shall fill out completely and sign Contractor's Material and Test Certificate provided in NFPA-13 and submit to Engineer for approval and thus system acceptance.
- C. Spurious Alarms
 - 1. If the Owner experiences an unacceptable number of spurious or unexplained false alarms during the installation and guarantee periods, the Contractor shall be responsible for providing the necessary labor, material and technical expertise to correct the problem to the satisfaction of the Owner.
 - 2. Any spurious alarms associated with waterflow devices or valve supervisory switches, range hood and duct fire suppression system monitoring devices, or monitoring of special suppression systems are considered unacceptable.
 - 3. The Contractor shall coordinate with the fire alarm contractor to resolve spurious or unexplained false alarms.
- D. Keys and Special Tools
 - 1. The Contractor shall supply the Owner with three complete sets of any special tools or keys necessary for normal operation and maintenance of the system. Keys and locks for equipment shall be identical.

21 00 16 SPACE CLASSIFICATION

- A. The most stringent of NFPA-13, local practices, or the following criteria shall be used in the sprinkler system design and hydraulic calculations.

- 2) Ordinary Hazard, Group 1: Attic Mechanical Space
 - B. The hazard protection level shall be increased as required for areas with hazardous materials, flammable and combustible liquids, or storage that requires additional protection per NFPA 13. The sprinkler design criteria for spaces with hazardous materials and/or flammable and combustible liquids shall be in accordance with NFPA 30 and the requirements for Extra Hazard occupancies of NFPA 13.
 - C. Reduction in design area shall be permitted for quick response sprinklers in accordance with NFPA 13.

21 00 20 PIPING AND ACCESSORIES

21 00 22 PIPING MATERIAL AND FITTING SCHEDULE

- A. Size: 2-1/2" and larger above grade.
 1. Pipe: Schedule 40 seamless steel piping with bacterial resistant internal coating.
 2. Fittings: Butt-welded, groove-end, forged steel flanged, thread-o-let, weld-o-let.
 3. Joints: Butt welded, groove-end couplings, flanged.
 4. Tests: Hydrostatically at not less than 200 psi for two (2) hours per NFPA 13, Section 8-2
- B. Size: 2" and smaller above grade.
 1. Pipe: Schedule 40 seamless steel piping with bacterial resistant internal coating.
 2. Fitting: Cast iron or malleable
 3. Joints: Screwed, groove-end.
 4. Tests: Hydrostatically at not less than 200 psi for two (2) hours per NFPA 13, Section 8-2.2.
- C. The following types of fittings are prohibited: plain end couplings and fittings, saddle/mechanical/clamp branch tee, grooved flange rings, and grooved reducing couplings.
- D. Pipe velocities shall not exceed 14 feet per second in any section of the piping system.

21 00 40 SECTION NOT USED

21 00 50 DRY PIPE SPRINKLER SYSTEM

21 00 51 SPRINKLER HEADS

- A. All sprinkler heads are to be Quick Response liquid in glass bulb type, with a minimum of 1/2 inch orifice, 1/2 inch NPT and a K factor of 5.65. Sprinklers having an orifice larger than 1/2 inch shall be 3/4" NPT.
- B. In unfinished spaces or in concealed locations, upright sprinkler heads with a natural bronze finish shall be used. Heads shall be equivalent to the Viking Microfast Model M or Tyco TY-FRB.

- C. Sidewall sprinklers where utilized in Unobstructed Construction shall be horizontal recessed type with a white factory finish. Heads shall be equivalent to Viking model M, Reliable model G3, Tyco TY-FRB.
- D. Temperature range and response time shall be suitable for the location and the expected heat release. Within a space all sprinklers should be the same Temperature Range and Response Time to avoid "skipping".

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22 00 00 PLUMBING WORK

22 00 01 GENERAL

- A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 22 of the Specifications.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 22 of these Specifications.

22 00 02 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.

22 00 03 RELATED SECTIONS OF THE SPECIFICATIONS

The following sections of the Specifications apply to Work under this Section:
Division 20 - Basic Mechanical Conditions and Basic Mechanical Material and Methods

22 00 04 DEFINITIONS

Refer to section 20 00 05.

22 00 05 WORK INCLUDED

- A. Furnish material, labor and services necessary for and incidental to providing the following Plumbing Work where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Subsection 20 00 43) to perform the Work completely.
 - 1. Sanitary waste system, including but not limited to, sanitary piping, vent piping, acid waste, acid vent piping, plumbing fixtures, floor drains, and cleanouts.
 - 2. Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.
 - 3. Draining, filling, and venting of all modified systems as required for the above work. This includes scheduling shutdowns with the Owner. (Refer to Section 20 10 70).
 - 4. Smoke stopping of all penetrations of pipes and firestopping of the same through fire rated partitions as shown on the architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits. (Refer to Section 20 10 20).
 - 5. Cleaning and pressure testing equipment, piping, and accessories installed under this section of the specification. (Refer to Section 20 10 50).
 - 6. All seismic restraints for the above work. (Refer to Section 20 10 40).
 - 7. Installing accessories specified under other sections of the specification referenced in subsection 20 00 05.

22 00 06 SUBMITTALS (SEE SUBSECTION 20 00 43)

- A. The Contractor shall submit the following shop drawings for approval in accordance with Subsection 20 00 43 - Submittals.
 - 1. Piping materials as specified in Piping Material Schedule(s) in subsection 22 20 00.

2. All general items specified under Division 20 utilized in the installation of work required by this section of the specification.
- B. Provide manufacturer's technical product data of each material and accessory item with engineering support information and recommended installation procedure. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.
- C. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

22 00 07 SPECIAL REQUIREMENTS

- A. Where lines installed under this section of the specification tie-in to existing lines Contractor shall verify all existing lines, their elevations and directions of flow before running any new lines.
 1. Contractor shall notify Architect/Engineer upon discovery if the new line cannot tie-in to the existing line due to location, elevation, size, or direction of flow.
- B. Prior to excavation, best efforts shall be made to locate lines with cameras, locating sondes, ground penetrating radar, etc.
- C. Protection:
 1. Protect drains during entire construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 2. Place plugs in the ends of uncompleted piping at the end of each day or when work stops.

22 00 08 CLOSE-OUT REQUIREMENTS

- A. Refer to General Conditions and Division 20.
- B. As-built drawings of underground plumbing shall include dimensions from walls/columns and invert elevations.
- C. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping are smoke or fire stopped as required by the Code.

22 20 00 PLUMBING PIPING SYSTEMS

- A. General
 1. Furnish and install the piping systems shown on the Plans and as hereinafter specified in the respective PIPING MATERIAL SCHEDULE. Include all necessary considerations in the related sections of the Specifications (subsection 22 00 05) to provide for complete systems.
- B. All drainage lines shall be flushed clean at the completion of the Work. Rod out any obstructions encountered.
- C. Main vents shall be the same size as waste lines and shall extend 12" minimum above the roof. Minimum vent thru the roof (VTR) shall be 3" size.

22 20 01 PIPING MATERIAL SCHEDULE P-1

- A. Service: Sanitary waste (SAN), and Vent (V), above grade where concealed within pipe chases, or non-return air plenum.
1. Design: Pressure: gravity vented.
Temperature: 140 degrees F.
2. Pipe: Schedule 40 PVC solid core.
3. Fittings: Schedule 40 PVC DWV
4. Joints: Solvent.
- B. Flashing: Provide 6 #/SF sheet lead flashing consistent with the type of roof construction x 12" high for all vents-thru-roof (VTR), except for membrane type roofing only which flashing shall be provided by roofing contractor. Minimum VTR shall be 3" size (see also 20 10 26).
- C. Test: Pressure test at not less than 15 feet static head of water for two (2) hours minimum.

22 20 12 PIPING MATERIAL SCHEDULE P-2

- A. Service: Acid waste and vent, above grade plenum rated
- B. Design: Pressure: gravity vented.
Temperature: 140 degrees F.
- C. Pipe: Schedule 40 PVDF, ASTM 25/50 rated for plenum used
- D. Fittings: Schedule 40 PVDF, molded electrical fusion type. Except final connection to existing pyrex piping shall be mechanical joint.
- E. Joints: Electrical fusion coils energized by a low voltage power supply. Except final connection to sink tailpiece shall be mechanical joint.
- F. Test: Pressure test at not less than 15 feet static head of water for two (2) hours minimum.

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23 00 00 HVAC PIPING AND EQUIPMENT

23 00 01 GENERAL

- A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 20 of the Specifications.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Division 20 of these Specifications.

23 00 02 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 20.

23 00 03 REFERENCES, RELATED SECTIONS OF THE SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

Division 20 - Basic Mechanical Conditions and Basic Mechanical Materials and Methods

Division 24 – Air Distribution

Division 25 - Temperature Controls

23 00 04 DEFINITIONS

(none)

23 00 05 WORK INCLUDED

- A. Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications (Sub-section 23 00 03 to provide for complete systems.

Cooling system including, but not limited to, piping, piping specialties.

Heating system including, but not limited to, piping, piping specialties.

Air handling equipment including, but not limited to, central station air handling unit/terminal units, exhaust fans.

Draining, filling, and venting of all modified systems as required for the above work. This includes scheduling shutdowns with the Owner (Refer to Section 20 10 70).

All seismic restraints for the above work (Refer to Section 20 10 40).

Smoke stopping of all penetrations of pipes and ductwork, and firestopping of the same through fire rated partitions as shown on the Architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits (Refer to Section 20 10 20).]

Cleaning and pressure testing equipment, piping, and accessories installed under this section of the specification. (Refer to Section 20 10 50).

Provide sufficient labor and resources required for the testing and balancing (Refer to Section 20 10 80) and for the commissioning process (Refer to Section 152300).

Installing accessories specified under other sections of the specification referenced in Sub-section 23 00 05, including but not limited to, control valves, thermowells, and taps for pressure sensors.

23 00 06 SUBMITTALS:

- A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.

Piping materials, valves, and accessories as specified in Piping Materials Schedule(s) in this section of the specification.

All HVAC equipment specified in this Division 23.

All general items specified under Division 20 utilized in the installation of work required by this section of the specification.

- B. Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.
- C. At the point where the mechanical system has been installed and checked by the Contractor and the systems are ready for testing and adjusting, submit a letter to the Architect/Engineer stating such. Refer to Section 20 10 85.
- D. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

23 10 00 HYDRONIC PIPING

- A. Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 Basic Materials and Methods.
- B. Manufacturer's mill reports and applicable documents to certify the validity of the procured piping materials shall be on file at the Contractor's office.
- C. Install all piping with pitch to vent or drain. Provide drain valves at low points and air vents at high points. Drain valves and air vents shall be ¾" bronze 2 piece body ball valves with ¾" hose end adapter, cap and chain. In ½" through 2" pipe, contractor may use Webstone model T-drain. Use eccentric reducing fittings (installed top level) as required to avoid air pockets.
- D. Gaskets and packings containing asbestos are not acceptable.
- E. Where Pipe and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

23 10 01 PIPING MATERIAL SCHEDULE, M-1

- A. Service: Chilled water supply and return for HVAC.
Hot water (heating) supply and return for HVAC.
- B. Rating: 125 psig at 350°F
175 psig at 150°F
- C. Pipe: (Refer to Section 20 10 11)

1. 3" and smaller Copper, type L.
 4. Contractor has the option on piping 3" and smaller to use either copper or black carbon steel. Fittings shall be as scheduled below for the piping material chosen.
- D. Fittings: (Refer to Division 20 10 10)
1. 3" and smaller Wrought copper, solder ends.
 3. Steel Pipe Black carbon steel, butt weld. Elbow fittings shall be long radius. See Division 20 10 00 for acceptable branch arrangement in lieu of tee fitting. Wall thickness consistent with connecting pipe.
- E. Joints in Steel Piping: (Refer to Division 20 10 30)
1. 2-1/2" and smaller Screwed
- F. Joints in Copper Piping (Refer to Division 20 10 30):
1. All 95/5 solder
- G. Valves: (Refer to Division 20 10 10)
1. Shut-off/service:
 11. 3" and smaller Ball valve: two piece bronze body, stainless steel ball and trim.
 2. Balancing/Throttling:
 21. 12" and smaller Multi-turn calibrated balance valve.
 5. Unions:
 51. 3" and smaller Wrought copper, solder ends.

23 10 02 PIPING MATERIAL SCHEDULE M-2

- A. Service: Condensate drain piping.
- B. Design: Atmospheric
- C. Pipe: Type L copper
- D. Fittings: Wrought copper, solder ends. 90° elbows are not permitted, use (2) 45° elbows or 'Y' provided with cap in unconnected straight run.
- E. Extend piping from all cooling coil drain pans to the location of discharging indirectly to the building drain system. Pipe size shall be unit connection size unless indicated larger on the plans.

- F. Connections to the drain pans shall be made through a water seal trap with the downstream side vented to atmosphere.

23 21 40 - 23 73 00 SECTIONS NOT USED

23 73 00 AIR HANDLING UNITS

23 73 01 CUSTOM DOUBLE WALL UNITS – OWNER FURNISHED CONTRACTOR INSTALLED

- A. Furnish and install air handling units as specified below, and as described in diagrams and schedules on the drawings. The unit shall include frame casing, insulated drain pans, heating and cooling coils, fan assemblies, access panels for easy access to all service points, bearings, motors and drives and guards.
- B. The units shall be constructed of welded or bolted angle or channel steel frames. The entire frame assembly shall be hot dipped galvanized after fabrication, or suitably treated with a rust inhibitor coating. The casing shall be 2-inch solid double wall G90 galvanized metal with foam injected panels. The casing shall be rated per ASHRAE/ANSI 1350 to meet or exceed the following: L/240 deflection at 8" positive and negative pressures – Class CD2; Class CL6 Leakage at 8" positive and negative pressures; R-13 Class CT1; Thermal bridging Class CB0. Hinged access doors with camlocks and heavy duty hinges shall be provided for ready access to bearings, motors, drives, coils, piping devices and connections, and other points required for maintenance service or inspection. Condensate drain pans shall be installed with 2" of insulation provided between the drain pan and the casing and shall drain both the coil and the fan; units with multiple vertically stacked coils shall have an intermediate drain pan. The pans shall be of continuously welded seams, Series 300 stainless steel construction, 'V' shaped and/or sloping to the drain connection, flat pans will not be acceptable. Drain pans shall be located in the coil section and in the fan section.
- C. Entire air handling unit shall set on base rails to allow deep condensate trap and where shown on the plans extended base rails shall be provided to support external filter housing and sheet metal transitions. Base rails shall be a minimum of 6" height where no size is indicated on the plans. The exterior of the unit shall be G90 galvanized metal or shall be painted with a minimum of two coats of factory applied rust inhibitor paint or enamel.
- D. Fans shall have capacities and minimum wheel diameters as indicated on the schedules. Each fan shall be of the non- overloading centrifugal type with deep drawn inlet rings, streamlined housing and scroll, with blades continuously welded to the flange, solid backplate, full curved shroud, and flanged discharge collar. Where Class II construction is required, wheels shall be reinforced with a welded intermediate ring. Fan bearings shall be heavy duty, self-aligning, grease lubricated, antifriction type with double row rollers and labyrinth grease seals. Grease fittings shall be extended through the unit housing. Provide drain openings at the bottom of each fan scroll. Each fan shall be equipped with an adjustable pitch V-belt drive selected for 1.5 times the motor horsepower, motor sliderail base and dripproof motor. Fans and motors shall be resiliently mounted on a single structural base, internally mounted with resilient mounts on the unit structural frame. Fans shall be airfoil or backward inclined as scheduled. Forward curved fans may be used only where specifically scheduled. Internal resilient mounting shall be spring type with minimum 1-1/2" static deflection and provided with seismic restraints.
- E. Manufacturer shall use the most energy efficient fan option within the manufacturer's line for the unit size but in no case will the wheel be smaller than the diameters scheduled.
- F. The units shall be provided with coils of the types and capacities scheduled. Cooling coil casing shall be Series 300 stainless steel, others shall be galvanized steel. Coils shall be constructed

with no less than ½" diameter x .020" wall thickness copper tubes and .0075" aluminum or copper fins spaced not closer than 8 per inch. Fins shall be permanently secured to the tubes by mechanical bonding or soldering and shall be plate type. Frame shall be shall include intermediate tube supports to prevent sagging of the tubes. The coil shall be removable with removing casing panels (i.e., casing shall have its own internal frame and shall not use the coil for support).

[Water coil] headers and "U" bends shall be arranged so that the entrained air is carried along with the flow of water through the coil to the high point on the leaving water header. High points in the coil shall be provided with vent connections. Multi-row coils shall be arranged for counterflow heat exchange between the air and water.

[Refrigerant coils] shall be row split or interlaced type with equalizing distributors. Coils shall be tested to 300 psig and shipped with a holding charge of dry nitrogen. Tube diameters, wall thickness, and fins shall be the same as above.

[Steam coils] shall be one pass (opposite and connections) non-freeze distributing tube type with concentric steam supply and condensate return tubes. Inner steam supply tubes shall have orifices for even distribution of steam.

G. The units shall be MarCraft, Fanwall, Ventrol and Trane.

23 82 00 TERMINAL UNITS

23 82 01 VARIABLE VOLUME UNIT

- A. Unit casing shall be welded, galvanized steel. Leak rate shall be not more than 1% of rated capacity at 4" wg. Interior surface of unit casing shall be acoustically and thermally lined with 1/2 inch thick, minimum of 1.5 lb./cu. ft. density glass fiber with foil face. Insulation shall be UL listed and meets NFPA-90A and UL 181. Factory mounted, removable panel on bottom of unit providing access to air valve and entering airside of coil. Straight flange or slip and drive rectangular discharge duct connection.
- B. Air valve shall be a 90° rotational damper flow control device with factory installed direct digital controls (DDC). All controls shall be furnished under Division 25 and mounted and wired in the factory by unit manufacturer. Manufacturer shall provide multiple point averaging flow sensing ring with high and low pressure pneumatic tubes compatible with DDC velocity pressure sensor. A calibration chart shall be provided on each unit.
- C. At the Contractor's option Division 25 may field mount controls at no additional cost to the Owner.
- D. Units shall be as manufactured by Titus, Price, or Trane.

23 82 02 FAN COIL UNITS

- A. Furnish and install fan coil units as specified and as shown and scheduled on the drawings. Capacities shall be certified in accordance with ARI Standard 440-latest edition.
- B. The basic unit shall be constructed of galvanized steel and insulated to meet the ARI Fan-Coil Industry test standard for insulation efficiency. Coils, motor speed control, electric junction box, primary and auxiliary drain pans, motor board, motor(s), and fan(s) shall be included in the basic unit.

Exposed wiring shall be in flexible conduit. Unit mounted electrical devices shall be prewired to a junction box. Units shall comply with Underwriters' Laboratories standard No. 883 for

Room Fan Coil Units. All unit/cabinet styles: shall have a factory installed and wired disconnect switch. Disconnect switch shall be Hubbell model HBL-1221 or equivalent.

Unit shall have an externally insulated stainless steel condensate drain pan/trough. An auxiliary drain pan located in end pocket shall be molded plastic. Drain surfaces shall be separate from the motor board assembly.

Insulation shall be 1/2" thick, 2 lb. density, foil faced fiberglass with no exposed fiberglass to the air stream.

Motors and fans shall be mounted on a removable galvanized steel motor board assembly. Wiring shall have a modular plug to allow removal of the motor board from the unit without tools.

Fan wheels shall be metal centrifugal forward curve type, dynamically balanced. Fan housing shall be constructed of galvanized steel with streamlined air inlets.

- C. Cooling coils shall be constructed of 1/2" O.D. seamless copper tubes mechanically bonded to aluminum fins. The entire coil assembly shall be factory tested with 300 psig air pressure when the coil is submerged in warm water. It shall have a maximum working pressure of 200 psig. Each coil shall be provided with a manual air vent.

Auxiliary heating coils shall be constructed of 1/2" O.D. seamless copper tubes mechanically bonded to aluminum fins. The coils shall be tested at 300 psig air pressure under warm water, and shall have a maximum working pressure of 200 psig. Each coil shall be provided with a manual air vent.

- D. Motors shall be resilient mounted, permanent split capacitor, totally enclosed, tap wound for 3-speed, with integral thermal overload protection and automatic reset. Minimum power factor shall be .96. Motors shall be permanently lubricated with provision for re-oiling. High static motors shall be provided as scheduled or as need to meet the scheduled performance.

- E. Exposed floor mounted cabinets:

Cabinets shall be constructed with 16 gauge steel fronts, tops, and end panels. Cabinet shall have 18 gauge back panel. Fronts, backs, sides, and top panels forming the air flow path shall be insulated for maximum thermal and acoustical performance. Cabinet parts shall be cleaned and phosphatized before painting.

Cabinets shall have extended 9" end pockets on both sides. Top panel shall not have access doors.

Front panels shall be one piece, tamper proof, secured to the unit without visible fasteners. Units shall have four leveling bolts.

The finish shall be baked enamel with color selected by Architect, from the manufacturer's standard colors.

Units shall have 4-way double deflection, steel painted to match the unit supply grill.

- F. Filters shall be 1" pleated fiberglass media 30% (MERV 7) throw-away filters. Furnish and install one complete set of filters for start-up and one complete set of filters following substantial completion and acceptance.

- G. Factory Valve Package:

None

- H. Fan coil units shall be Trane, Airtherm, Engineered Air, Superior Rex, or approved equivalent.

23 82 03 LAB AIR CONTROL SYSTEMS

A. CONSTANT VOLUME AIRFLOW CONTROL DEVICE

1. The airflow control device shall maintain a constant airflow set point. It shall be factory characterized and set for the desired airflow. It shall also be capable of field adjustment for future changes in desired airflow.
2. Constant volume valves must be 100% mechanically pressure independent, and require no actuation to maintain set point.
3. Constant volume valves shall have no required electronics to maintain set point.
4. The airflow control device for corrosive airstreams, such as fume hoods and biosafety cabinets, shall have a baked-on, corrosion-resistant phenolic coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal "S" link shall be made of 316 or 303 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. All shaft bearing surfaces shall be made of PP (polypropylene) or PPS (polyphenylene sulfide) composite.
5. Units shall be as manufactured by Phoenix or approved equal.

B. FUME HOOD DISPLAY

1. The display screen shall be a Phoenix Controls Sentry 3.2" (diagonal) color LCD resistive touch screen (240 x 320 RGB).
2. A Lon Room Controller shall be provided for communication interface between the pressure switch on the air valve and the fume hood display.
3. The touch screen shall support input configurations for fume hood operational parameters done at the touch panel and at a minimum including:
 - a. Sash Dimensions
 - b. Hood ID
 - c. Hood Certification Reminder
 - d. Hood Occupancy Status
 - e. Stopwatch/Timer
 - f. Message Display
4. Display shall be Phoenix FHD-110-ENG or approved equal.

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24 00 00 AIR DISTRIBUTION

24 00 01 GENERAL

1. This Section specifies air distribution systems.
2. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Divisions 20 - 29 of the Specifications.
3. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 20 - 29 of these Specifications.

24 00 02 REFERENCES, REGULATORY REQUIREMENTS:

- A. Work for this section of the specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:
 1. ASHRAE, "Handbook 1997 Fundamentals"; Chapter 32 - Duct Design.
 2. ASHRAE, "Handbook 1996 Equipment"; Chapter 16 - Duct Construction.
 3. ASTM A90-81 (1991), "Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles".
 4. ASTM A525-91b, "Spec for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process".
 5. ASTM A527/A527M-90, "Spec for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality".
 6. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 7. SMACNA "HVAC Duct Construction Standard – Metal and Flexible" – Second Edition.
 8. UL 33, "Heat Responsive Links for Fire Protection Service."
 9. UL 555, "Fire Dampers and Ceiling Dampers."
 10. UL 181, "Factory Made Air Ducts and Connectors."

24 00 03 REFERENCES, RELATED SECTIONS OF THE SPECIFICATIONS

Requirements of the following Sections of the Specifications apply to Work for this Section:

- A. Division 20 - Basic Mechanical Conditions and Basic Mechanical Materials & Methods
- B. Division 23 – HVAC Piping and Equipment
- C. Division 25 - Temperature Control

24 00 04 DEFINITIONS

- A. The size of the ducts shown on the drawings and in this Section of the Specifications shall be the outside dimension of the ductwork which will take into account any internal acoustical lining thickness specified for duct system or sub-system.
- B. The term **"supply air"** where used in this Section of the Specifications shall mean downstream of a coil.
- C. The term **"outdoor air"** where used in this Section of the Specifications shall mean ambient air that has not been conditioned.

- D. The term **“return air”** where used in this Section of the Specifications shall mean conditioned air that is returned from the space.
- E. The term **“mixed air”** where used in this Section of the Specifications shall mean air streams that are a mixture of **“outdoor air”** and **“return air”**.
- F. The term **“relief air”** where used in this Section of the Specifications shall mean excess return air that relieved from the building.
- G. The term **“exhaust air”** where used in this Section of the Specifications shall mean air that is removed due to contaminates, odors, or heat.

24 00 05 WORK INCLUDED

Furnish material, labor and services necessary for and incidental to the installation of the following systems where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the Specifications (Sub-section 20 30 03) to perform the Work completely.

- A. Sheet metal ducts, sheet metal plenums, dampers and accessories.
- B. Installing accessories specified in referenced sections above.
- C. Smoke stopping of all penetrations of ductwork, and firestopping of the same through fire rated partitions as shown on the Architectural drawings including, but not limited to stairways, shafts, corridors, floors, roofs, and required exits (Refer to Section 20 10 20).
- D. Contractor shall coordinate his work with the work of other trades, and with the architectural and structural drawings.

24 00 06 SUBMITTALS

- A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of Contractor - Submittals.
- B. Submittals shall include drawings showing joining methods, location of duct transverse joints, and duct support locations.
- C. Submittals shall be required for all shop fabricated balancing dampers.
- D. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

24 00 07 SPECIAL REQUIREMENTS

- A. Contractor shall inspect each component of the heating and air conditioning system to eliminate rattles, air whistles, vibration, and mechanical system sound transmission. Rough edges in ducts, insecure dampers, turning vanes, fire dampers, etc., shall be corrected to assure no recurrence of the noise source. Each vibration isolator and flexible connector shall be adjusted to limit transmission of sound to the occupied space.
- B. Where Ductwork and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical tracing of ductwork, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

24 00 08 AIR DISTRIBUTION CLEANLINESS

- A. Contractor shall implement procedures to maintain an “Advanced Level” of ductwork cleanliness per the latest addition of the SMACNA Duct Cleanliness for New Construction Guidelines.
1. Production and Site Delivery:
 - a. Self-adhesive labels for part of identification are to be applied to the external surfaces only.
 - b. During transportation, ductwork and air distribution components shall be sealed either by blanketing or capping the duct ends, bagging small fittings, surface wrapping or shrink wrapping.
 2. Site Storage:
 - a. Temporary storage shall be located away from high dust generating processes such as masonry, tile cutters, saws, drywall sanding, mortar and plaster mixers, roof pitch kettles, portable electric generators, and main walkways that will be constantly broom swept.
 - b. Temporary storage shall include pallets or blocking to keep ductwork and air distribution components above floor surface to prevent water damage.
 - c. Coverage should be used to protect stored materials at all times.
 - d. Duct open ends and air side of air distribution components shall be securely sealed at all times.
 - e. Seals shall be visually examined and if damaged, resealed with an appropriate material.
 3. Installation:
 - a. Before installation of individual duct sections and air distribution components, they are to be inspected to ensure that they are free from debris and shall be wiped clean if debris exists.
 - b. The working area shall be clean, dry, and the airside of ductwork and air distribution components protected from dust and moisture.
 - c. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.
 - d. Open ends on completed ductwork shall be sealed immediately if left for an extended period of time (work breaks, overnight, etc.).

24 31 00 SHEETMETAL DUCTWORK

24 31 01 MATERIAL

- A. General exhaust duct unless specified otherwise shall be constructed from sheets or rolls of G-90 or better-galvanized steel, LFQ, Chemtreat. Fiberglass ductboard is prohibited. Fittings connecting general exhaust to stainless steel fume hood exhaust shall be 316 stainless steel.
- C. Hazardous exhaust from fume hoods shall be constructed from 316 stainless steel.
- D. All exhaust ductwork upstream of terminal units (near air inlet) shall be constructed of gauges and reinforcement to -2” w.g. static pressure in SMACNA Duct Construction Standard – Latest Edition. Exhaust ductwork downstream of air valves shall be constructed to -6” w.g. static pressure.

- E. Where local code requires gauges heavier than required by SMACNA then the local code shall govern.

24 31 02 CONSTRUCTION

- A. General Exhaust prior to tie-in to fume hood exhaust ductwork
 - 1. All ductwork shall be neatly constructed, stiffened, on the outside surfaces where necessary to prevent perceptible vibration or buckling. All ducts, housings, etc., shall be fabricated as detailed on the drawings and in the SMACNA Duct Construction Manual – Latest Edition.
 - 2. All rectangular ducts unless specified otherwise shall be “Pittsburgh Lock” longitudinal joints. Snaplock is not acceptable.
 - 3. All round ducts and flat oval ducts shall have spiral seams or continuously welded longitudinal seams.
- B. All Exhaust Ductwork transporting Fume Hood Exhaust
 - 1. All round and rectangular ductwork shall be continuously welded 316 stainless steel.
- C. Ducts shall be securely supported in accordance with SMACNA Duct Construction Manual – Latest Edition and in no case less than double thickness 1” x #24 gauge galvanized metal. Cable hangers are not allowed.
- D. Ducts that are to be externally insulated shall not be supported on unistrut channel unless it required based upon loading. Hanger rods for trapeze bars shall be spaced to allow for insulation installation.

24 31 03 SEALING – FOR GENERAL EXHAUST

- A. Duct sealant shall be flexible, water-based, adhesive sealant designed for use in 4” static pressure systems. Sealer shall be UL listed and conform to ASTM E84. Sealer shall be equal to Ductmate PROseal, United McGill Uni-Mastic, Duro-Dyne DSW, or equivalent.
- B. All supply ductwork unless specified otherwise shall be SMACNA's seal class A.
- C. All return, exhaust, outdoor air, relief and supply ductwork downstream of terminal units shall be SMACNA's seal class B.

24 31 04 FITTINGS

- A. Rectangular duct branch take-offs, or rectangular to round, shall be 45°-boot fittings, spin in fittings are not acceptable.
- B. Rectangular duct proportional splits shall be made the sizes as shown on the drawings. Where duct sizes are changed from the original design, Contractor shall proportion split equal to the split in airflow.
- B. Rectangular duct changes in direction:
 - 1. 90 degree elbows, refer to plans, shall be mitered with turning vanes; or radiused with centerline radius to width ratio of 0.75 (inside radius/width ratio 0.25 with curve ratio 0.585) with 2 splitter vanes.
 - 2. 45 degree and less elbows shall be mitered without vanes.
 - 3. Elbows other than above shall be radiused with centerline radius to width ratio of 1 without splitter vanes.

- C. Round or Oval elbows and changes in direction shall have a minimum centerline radius of 1-1/2 that of duct size. Round or oval branch take-off shall be 45 degree booted style similar to McGill Airflow Lo-Loss Tee.
- D. When approved by the Engineer ducts may be notched at structural steel. The converging angle shall be no greater than 30°, the diverging angle shall be no greater than 15°.
- E. When approved by the Engineer objects may penetrate a duct. An airfoil shape shall be placed around the object to minimize turbulence.

24 33 00 AIR DISTRIBUTION ACCESSORIES

24 33 01 BALANCING DAMPER

- A. Furnish and install volume dampers at each main branch take-off and in such other locations where required to properly balance the air distribution systems.
- B. All dampers, except those located downstream from terminal units used to adjust individual grilles, shall have frames and bearings and shall have quadrant lock regulators with thread screw to allow damper to be securely locked into place.
- C. Balancing dampers downstream from terminal units that are contractor fabricated or apart of manufactured branch fitting shall be a minimum of 18-ga. plate, 3/8" continuous shaft with locking quadrant handle equal to Duro Dyne model Quadline.
- D. Rectangular dampers up to size 24" x 12" shall be Ruskin MD25, Nailor 1870, Arrow, Air Balance, NCA, or shop fabricated equal, approved by the Engineer.
- E. Round dampers up to size 20" diameter shall be Ruskin MDRS25, Nailor 1890, Arrow, Air Balance, NCA or shop fabricated equal, approved by the Engineer.
- F. Rectangular dampers larger than 24" x 12" shall be Ruskin MD35, Nailor 1820 or equivalent manufactured damper by NCA.
- G. Where volume dampers are to be adjusted through walls or ceilings, such dampers shall be operated by regulators designed for recessed installation and provided with a cover plate which shall be flush to the surface of the wall or ceiling. Concealed regulators, as manufactured by Duro Dyne Corporation or Elgen shall be of the indicator type. Regulator shall be provided with a spring washer for non-binding adjustment and hex lock nut in addition to wedge pin which shall be installed to prevent damper rattle. Cast alloy regulator housing, with "open to shut" range positioning markers, shall be secured with removable cover to expose regulator for adjustments.
- H. All automatic dampers and control dampers shall be as specified in Division 25, "Temperature Control". Dampers shall be furnished under Division 25 for installation under Division 23 30 00.
- I. Control Damper Installation
 - 1. Dampers installed in walls shall be installed with wall sleeves to allow direct coupled actuator installation.
 - 2. Large damper installations with multiple actuators shall be installed with 8" sheetmetal blank-off/spacers between them to allow direct coupled actuator installation. Provide structural supports as required for a straight, true, level and square installation.
 - 3. Dampers shall be attached with fasteners on 6" centers with a minimum of 2 per side.

24 33 02 AIR TURNING VANES

- A. Furnish and install directional air turning vanes in ductwork at all 90 degree mitered elbows and 90 degree radiused elbows.
- B. Mitered 90 degree elbows vanes shall be:
 - 1. Single rolled type with a radius of 2" with 1.5" spacing.
 - 2. Single rolled type with a radius of 4-1/2" with 3.25" spacing.
 - 3. Double thickness type with a radius of 4-1/2" with 3.25" spacing. Double thickness 2" radius is not allowed.
 - 4. Tie rods shall be used to limit the maximum unsupported width per the type of vane used per SMACNA.
 - 5. Vanes shall be solidly installed and rattle-free locked into each slot of preformed vane guide rails as manufactured by Duro Dyne Corporation or Elgen. Components shall be of the same material as the system installed in (316 stainless steel for fume hood exhaust)
- C. Radiused 90 degree elbows shall have 2 vanes. Vanes shall be single thickness, Splitter Vanes for radius elbows shall be fabricated based on the "SMACNA HVAC Systems Duct Design Manual" using the appropriate curve ratio.

24 33 03 FLEXIBLE CONNECTORS

- A. Furnish and install flexible connections at the connections to air handling equipment as indicated on the plans. Flexible connections shall be U.L. listed fabric that meets NFPA 90A. It shall weigh not less than 24 oz per sq. yd and have a tensile strength of not less than 500 psi. Flexible connections shall be preassembled "Super Metal-Fab" with 6" fabric attached to 3" metal on either side by means of "Grip-Loc" seam. At least one inch of slack shall be allowed when making connection to insure that no vibration is transmitted from fan to ductwork. The flexible connectors shall be fastened to ductwork and equipment by screws, rivets or spot welding. Flexible connectors shall be No. MF6N as manufactured by Duro Dyne Corporation, or equivalent by Vent-Fabrics or Elgen.

END OF SECTION
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SECTION 25 00 00
CONTROL SYSTEMS

PART 1 GENERAL

1.01 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 provide and install control enclosures. Owner will provide controllers for contractors to install. After all equipment has been installed, wired and piped, Owner will provide controller programming Contractor will be responsible for all termination connections at the DDC controller's and for checking, testing, 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.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Special Conditions apply to work of this section.

1.03 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.
 - 4. NFPA Compliance: Comply with NFPA 70 "National Electric Code."

1.04 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

2.01 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.
 - f) Packing: Spring-loaded Teflon, self-adjusting.
 - 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 1/2-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.
- H. Fan 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.
- I. Relays Used for Fan Start/Stop: Must have LED indication and be mounted externally of starter enclosure or VFD.
- 1. Kele, RIBU1C or approved equal.
- J. 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.
- K. Pressure Differential Switch:
1. Fans: NECC model DP222 or approved equal.
- L. 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.
 - a) Setra model 230 with Kele model 3-VLV, three valve manifold or approved equal.
 3. 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.
- M. 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 1/4" compression fittings.
1. Kele model AFS-460-DDS, or approved equal.
- N. 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. 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).
5. The measuring device shall be UL listed as an entire assembly.
6. 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.
7. 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.

- O. 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.

PART 3 EXECUTION

3.01 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, described 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, described 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 magnehelic pressure gage across each air handling unit filter bank. If the air handling unit has a prefilter and a final filter, two magnehelic pressure gages are required.

3.02 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 house keeping 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 house keeping 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.

3.03 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

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DIVISION 26 - ELECTRICAL

26 00 00 ELECTRICAL

26 00 01 GENERAL

- A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 26 - 27 of the Specifications.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of 26 -27 of these Specifications.
- C. The organization of the Specifications into Divisions, Sections and Subsections, and the arrangement of the Plans shall not in and of itself divide the Work among the Contractors and Subcontractors nor establish the Work to be performed by any trade. The "Scope of Work" and "Work Included" under each respective sectional heading, nevertheless, attempts to segregate the Work by known contracting activities. In the final analysis, the General Contractor shall be responsible for scoping the work for each trade based on local practice to include all the Work of a given type in the related proposal, regardless of where and how identified in the Bid Documents.

26 00 02 SCOPE OF WORK

- A. This project is for a **Replacement of Schweitzer Hall Roof and Fume Hood Exhaust Fans for University of Missouri, Columbia.**
- B. The Electrical Work for this project shall include all material, labor and services necessary for and incidental to providing the following systems (respective Sections of the Specifications are noted in the right-hand column):

1. Basic Electrical Requirements	26 00 00
2. Communications and Systems	27 00 00

26 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

- A. The Plans, the general provisions of the of the Contract, including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of 26 -27 of the Specifications.
- B. All provisions and conditions cited in this Section shall apply to Work for all other sections of 26 -27 of these Specifications.

26 00 04 REFERENCES, REGULATORY REQUIREMENTS

- A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where relevant standards have been established (see also Paragraph 26 00 60). Material and equipment, which are not covered by UL Standards, will be acceptable provided they meet safety requirements of a nationally recognized testing laboratory. Products which no nationally recognized testing laboratory accepts, lists, labels, certifies or determines to be safe will be

considered if inspected or tested in accordance with national industrial standards such as NEMA or ANSI. Evidence of compliance shall include test reports and definitive submittals.

B. Definitions:

1. **“Listed”**: A product is “listed” if of a kind mentioned in a list which: Is published by a nationally recognized laboratory which makes periodic inspections of such production. States that such product meets nationally recognized standards or has been tested and found safe for use in a specified manner.
2. **“Labeled”**: The product is “labeled” if: It embodies a valid label or other identifying mark of a nationally recognized testing laboratory such as UL, Inc. Production is inspected periodically by a nationally recognized testing laboratory. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. **“Certified”**: The product is “certified” if: The product has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in specific manner. Production is inspected periodically by a nationally recognized testing laboratory. The product bears a label, tag or other record of certification.
4. **“Nationally Recognized Testing Laboratory (NRTL):”** An independent organization recognized by OSHA that functions to provide third-party evaluation, testing and certification of products requiring OSHA NRTL approval.

26 00 05 DEFINITIONS

- A. The term **“Work”** used in this Division shall be the furnishing of material, labor and/or services necessary for and reasonably incidental to providing specific component(s), consideration(s) and/or system(s) of the design for the mechanical facilities for this Project as hereinafter defined by the Project Documents.
- B. The term **“Project Documents”** used in this Division shall be the compilation of the Specifications, the Plans and any Attachment and Addendum which collectively define the design and the intent of the Work to construct the Project.
- C. The terms **“Architect”** and **“Engineer”** as used in this Division of the Specifications shall be the professional individual and/or company developing the respective portion(s) of the Project Documents and administering the responsibility for the adherence to the intent of these documents. The “Architect/Engineer” is the agent of the “Owner” and shall represent and discharge authority on all matters unless the matter is referred to the Owner or the Owner elects to perform in their own behalf.
- D. The term **“General Contractor, Construction Manager, or Prime Contractor”** as used in Division 26 shall mean the Contractor who has the prime contract with the Owner and who is responsible for general conditions of the project and is responsible for seeking experienced and qualified Trade Subcontractors to perform the Work.
- E. The terms **“Contractor”** and **“Subcontractor”** where used in this Division shall mean any Company, regularly in business, to perform the type of work for which the Contract was sought, who has contracted with the Owner or General Contractor to perform the work included in and defined by this section and any other section or sections of this Division.

- F. The term “**submittal**” as used in this Section of the Specifications shall be construed to be information in various forms compiled by the Contractor to transmit to the Architect/Engineer for review, comment and/or approval and return same to the Contractor with notice to react. The information shall support and/or substantiate that the given product complies with the intent of the Project Documents, should be incorporated in the Work and therefore, warrants approval to permit proceeding with that Work. The information may be any form or accepted practice of shop drawings, data, published catalogs, etc. that sufficiently provide the Architect/Engineer with basis of making a determination.
- G. The term “**unfinished space**” as used in 26 -27 of the Specifications shall be spaces such as a mechanical or electrical equipment rooms. These are rooms that are generally unpainted and accessible only to building maintenance personnel.
- H. The term “**finished space**” as used in 26 -27 of the Specifications shall mean any space not defined as “unfinished space” (i.e. occupied rooms, corridors, stairways, closets, etc.).
- I. The term “**exterior**” or “**outdoors**” as used in 26 -27 of the Specifications shall mean exposed to atmospheric weather conditions.
- J. The term “**interior**” or “**indoors**” as used in 26 -27 of the Specifications shall mean not exposed to atmospheric weather conditions.
- K. The term “**concealed**” as used in 26 -27 of the Specifications shall mean anything that is not visible in a “finished space”.
- L. The term “**inaccessible**” as used in 26 -27 of the Specifications shall mean located within walls or above non-lay-in ceiling (i.e., drywall, plaster) and as defined in Article 100 of the National Electrical Code.
- M. The term “**accessible**” as used in Division 26 – 28 of the Specifications shall mean as defined in Article 100 of the National Electrical Code.
- N. The term “**packaged**” as used in 26 -27 of the Specifications shall be construed to be a factory manufactured piece of equipment for which all components are totally assembled, pre-piped and prewired within its own structure and ready to operate when connected to proper external mechanical and electrical services.

26 00 06 CODES, STANDARDS, etc.

- A. The material, workmanship and systems for Work of this Division shall comply with all applicable codes, standards, regulations and laws of the legal governmental jurisdiction at the project site.
- B. Should the Contractor perform any work that does not comply with the requirements of the applicable codes, standards, regulations, statutes, laws, acts, or which does not receive the approval of the responsible inspection authority, Contractor shall bear all costs arising in correcting the deficiencies.
- C. Applicable requirements of the current and accepted edition of the following codes shall apply to the Work for Divisions 26 - 28:

International Building Code – 2021
International Plumbing Code - 2021
International Mechanical Code – 2021

International Existing Building Code – 2021 (for Level 1 & Level 2 Alterations only with preapproval from the AHJ)
International Fire Code - 2021
International Fuel Gas Code - 2021
International Swimming Pool and Spa Code - 2021
ICC A117.1 Accessible and Usable Buildings and Facilities – 2017 (all sections are now applicable)
National Electric Code/NFPA 70 – 2020
NFPA 150 Fire and Life Safety in Animal Housing Facilities Code - 2019
NFPA 110 Standard for Emergency and Standby Power Systems - 2019
NFPA 96 Standard for Ventilating Control and Fire Protection of Commercial Cooking Operations - 2017
NFPA 90A Installation of Air Conditioning and Ventilating Systems - 2018
NFPA 75 Standard for the Fire Protection of Information Technology Equipment - 2020
NFPA 72 National Fire Alarm Code – 2019
NFPA 51B Standard for Fire Prevention During Welding, Cutting, and Other Hot Work - 2019
NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals – 2019
NFPA 20 Standard for the Installation of Stationary Fire Pumps for Fire Protection – 2019
NFPA 14 Standard for the Installation of Standpipe, Private Hydrants and Hose Systems - 2019
NFPA 13 Installation of Fire Sprinkler Systems – 2019
ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality - 2019
ASHRAE 90.1 – Energy Standard for Buildings – 2019
ASME A17.1 – Safety Code for Elevators and Escalators - 2016
Americans with Disabilities Act – Standards for Accessible Design 2010

- D. Applicable requirements of the current and accepted edition of the following industry standards, codes and specifications shall apply to the Work for Division 26-28:

ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
IEEE	Institute of Electrical & Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NIST	Institute of Science and Technology
NEC	National Electric Code, including amendments by local authority having jurisdiction
NEMA	National Electrical Manufacturers Association
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Act
UL	Underwriters Laboratory, Inc.

- E. Applicable requirements of all the relevant Federal laws including current and accepted edition of the Americans with Disabilities Act (ADA).

26 00 30 PROJECT DOCUMENTS

26 00 31 GENERAL

- A. The Plans and the Specifications are intended to define complete and satisfactorily functioning systems. The Contractor shall be responsible for providing all necessary material, labor and

services to provide the completed, operating systems at no additional compensation even though each and every element thereof is not specifically identified.

- B. The Plans are diagrammatic and indicate general arrangements, approximate sizes and relative locations of principal equipment and materials to provide for the design and intent of the Electrical Work and shall be followed as closely as actual building and site conditions and work of other trades will permit. The Work shall conform to the requirements and intent of the Project Documents. Because of the scale of the drawings, the Plans do not represent every offset, fitting, accessory, etc. that may be required for the conduit or other appurtenances, nor is it implied that all conflicts between elements of the Work or building components have been resolved. The Contractor shall prepare details and/or coordination drawings where it may be required and submit to the Architect/Engineer for approval before proceeding with the Work.
- C. To the extent contained in the Project Documents, elevations, sections, typical details, and schematic diagrams are included for instructions to the craftsperson. If any additional diagrams are desired and/or required for further instruction to the craftsperson, for permit applications, or for any other reason, the Contractor shall develop the drawings.
- D. Significant discrepancies and/or changes required to accomplish the intent of the Project Documents, in the opinion of the Contractor, shall be identified and submitted to the Architect/Engineer for approval before proceeding with the Work in question. Changes originated by the Architect/Engineer shall be processed under the subsection heading "Changes in the Work".
- E. The Plans and the Specifications are mutually complementary. Work required by one, but not the other, shall be performed as if required by both.
- F. In the event of conflict between the Plans and the Specifications, the Contractor shall notify the Engineer for clarification. Prior to clarification, the Contractor shall assume that the stricter requirements apply.

26 00 33 SPECIFICATIONS

- A. Referenced sections of other Divisions whether attached or in separate volumes or binders shall be a part of the Contract Documents.

26 00 34 ADDENDA

- A. The Architect/Engineer may issue revisions, modifications, attachments or other documentation in the form of addenda to the Project (Bid) Documents during the bidding phase only to change, detail or clarify the scope of the Work.
- B. The addenda shall become a part of the Contract Documents.

26 00 35 INTERPRETATIONS

- A. The Architect/Engineer shall be the sole source of interpretation of the design and intent of the Project Documents.

26 00 37 AS-BUILT DRAWINGS

- A. The Contractor shall maintain a separate set of plans at the jobsite, and mark thereon as an As-Built of Work as the construction proceeds. These As-Built, "redline" drawings shall include exact locations and relevant details (i.e. elevations, sizes, dimensions related to building lines,

etc.) of all underground work, concealed feeders, pull/junction boxes, cable tray, all considerations requiring periodic attention and access thereto.

- B. At the completion of the project, the Contractor shall provide the "redline", As-Built drawings and/or scanned color PDF of the As-Built, flattened to the Engineer.
- C. At the completion of the project, the Architect/Engineer will provide PDF drawings (including all issued revisions to the Contract) for the Contractor's use to transfer all of the information from the As-Built drawings to a final, clean set.

26 00 40 DUTIES OF CONTRACTOR

26 00 41 GENERAL (Pursuit of Work)

- A. The Contractor shall thoroughly examine all Bid Documents before submitting a bid/proposal for the Work. If, in the opinion of the Contractor, there are any deficiencies in the Documents, that might impact the intent or the scope of the work, the Contractor shall bring the matter to the attention of the Architect/Engineer for clarification. If in the judgment of the Architect/Engineer clarification is warranted, an addendum to the Documents will be issued. If the Contractor fails to request clarification or otherwise submits a bid without qualifications, the Contractor thereby agrees to install a complete and functional system with no change in the contract price.
- B. The Contractor shall be responsible for changes required for compliance with codes, standards, regulations, ordinances, etc. and implementing any such change at no change in contract price. In the event of conflict with the Project Documents or other requirements, the more stringent shall apply. The Contractor shall promptly notify the Architect/Engineer of any discrepancy.
- C. The Contractor shall perform the Work to comply with all terms, conditions and intentions, whether explicit or implicit, of this Section and applicable requirements of other Sections of Division 26, the Plans and any other documentation so identified. Should the Contractor perform any Work that does not comply with the Project Documents or is not in accordance with common trade practices, the Contractor shall bear all costs, at no change in contract price, arising in correcting the Work.
- D. The Contractor shall be responsible for all aspects of the Work for their respective contractual agreement. The Work of the respective suppliers and subcontractors shall be administered properly to assure that all elements thereof have been provided for complete and functioning system(s).

26 00 42 SEISMIC ANCHORAGE, BRACING AND SWAY BRACING

- A. The Contractor shall be responsible for preparing drawings, calculations and details for any anchorage, bracing and/or sway bracing as required by the Authority Having Jurisdiction. Submitted drawings, calculations and details shall be signed and sealed by a Professional Engineer licensed in the State of Missouri.

26 00 43 SUBMITTALS for APPROVAL

- A. Prior to submitting shop drawings, Contractor shall verify equipment delivery for compliance with the overall project schedule. Any delays due to delivery or due to submittals being late, inadequate, or incorrect and therefore rejected by the Architect/Engineer shall be the responsibility of the Contractor making said submittal. The Contractor shall bear all cost for expediting charges or obtaining materials from another vendor to meet the overall project schedule.
- B. The Engineer may take up to two (2) weeks to review a complete and properly processed submittal from the time it arrives at the Engineer's office until the time it is returned to the Architect. Resubmittals will be reviewed within two (2) weeks for a complete and properly processed resubmittal from the time they arrive at the Engineer's office until the time they are returned to the Owner/Architect.
- C. The submittals shall include shop drawings, engineering data and support information to sufficiently substantiate compliance with the Project Documents. All submittals must include the following information in order to be considered for review. Submittals found to be lacking may be rejected without review.
 - 1. Shop drawing shall be derived from manufacturers original documents. Reproductions shall be of sufficient quality to accommodate a review.
 - 2. Stamped date of receipt by the Contractor(s).
 - 3. Identification of the project name and/or Owner's project number.
 - 4. Indication that the Contractor has reviewed the submittal and is satisfied that it complies with the Project Documents.
 - 5. Identification of the Specification section or subsection that specifies the submitted item.
 - 6. Identification of the submitted item by the same description that is used in the Project Documents.
- D. Submittals shall be delivered to the Engineer digitally via email, thumb drive, shared cloud drive, or other agreed upon means for review. Submittals or submittal notices that are emailed shall be sent to CA@mccclureeng.com at a minimum.
- E. The approval of the submittal shall not relieve the Contractor from complying with all of the terms and conditions of the Project Documents. The Contractor shall be responsible for all physical and performance requirements of equipment provided, including any differences in the cost of installation for variations from these requirements.
- F. Include the manufacturer's installation instructions and maintenance manual with the equipment submittal for approval for inclusion in the Operations and Maintenance Manuals as specified in Subsection 26 00 46.
- G. In general, all items purchased by Contractor for installation where a make and model is specified shall require submittals. Items required for the Work such as screws, bolts, clips, etc. which are not specified are not required to be submitted unless specifically requested.
- H. Submittal Matrix – The information within the following submittal matrix shall be required for approval prior to system installation.

1. Division 26 Required Submittal Information

SECTION	SUBMITTAL	CATALOG DATA	INSTALLATION INSTRUCTIONS	PROJECT SPECIFIC FACTORY DRAWINGS	WIRING DIAGRAMS	OPERATING INSTRUCTIONS	DIMENSIONAL DRAWINGS	DATA SHEETS (SCHEDULES, LABELING, ETC.)	COPY OF PROGRAM DETAILS	PARTS LIST	SERVICE AND MAINTENANCE INSTRUCTIONS	ONE LINE/ THREE LINE DIAGRAMS	CERTIFICATIONS	INSTALLER	CALCULATIONS	PHOTOGRAPHS
260923	LIGHTING CONTROL DEVICES	X	X		X	X										
262416	PANELBOARDS	X		X			X			X		X				
262726	WIRING DEVICES	X														
262816	DISCONNECTS	X	X													
262923	VARIABLE FREQUENCY DRIVES	X			X	X	X		X		X					
265113	INTERIOR LIGHTING FIXTURES	X														

- I. At the completion of the project provide a single PDF document containing only those shop drawings that were approved and incorporated into the project.

26 00 46 OPERATIONS AND MAINTENANCE MANUALS

- A. As a part of the contractual agreement, the Contractor shall submit and receive approval for the following. This information shall be submitted as soon as practical and while the Contractor is on site.
1. Provide digital PDF documents containing information on installation operation and maintenance for each piece of equipment supplied. Operation and Maintenance Manuals shall be the manufacturers original PDF documents.
 2. The Electrical Operations and Maintenance Manuals shall be submitted as separate files per specification section to the Engineer digitally via thumb drive, shared cloud drive, etc. for review.
 3. The information shall list any maintenance requirements and schedule for required maintenance.
 4. The information shall show all parts and part numbers of available replacement parts available for each piece of equipment.
 5. A cross-index of material and equipment furnished containing:
 - a. An alphabetical listing of material and equipment.
 - b. An alphabetical listing by manufacturer's name, address and contact person of the local sales representative.

- c. An alphabetical listing of all subcontractors including name, address, contact person, and specific work performed.

26 00 48 CLOSE-OUT REQUIREMENTS

- A. As a part of the contractual agreement, the Contractor shall submit and receive approval for the following before final payment will be released. This information shall be submitted prior to project completion:
 - 1. Operation and Maintenance Manuals
 - 2. As-built drawings.
 - 3. At the completion of the project, all contractors/subcontractors shall submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all penetrations are smoke or fire stopped as required by the Code.
- B. Close-out matrix:
 - 1. Division 26

SECTION	CLOSEOUT	CATALOG DATA	HIPOT TEST RESULTS	STARTUP AND OPERATING INSTRUCTIONS	TESTING CERTIFICATE	TRAINING CERTIFICATE	PARTS LIST	START-UP COMPLETION DOCUMENTS	PROGRAM FINAL SETTING	UL MASTER LABELS
260923	LIGHTING CONTROL DEVICES	X		X						
262416	PANELBOARDS	X								
262816	DISCONNECTS	X								
262923	VARIABLE FREQUENCY DRIVES	X		X				X	X	
265113	INTERIOR LIGHTING FIXTURES	X								

26 00 49 GUARANTEE

- A. The Contractor shall guarantee all material, equipment and workmanship provided for this project to be free from defects for a period of one (1) year after final acceptance. The guarantee shall include replacement of the defective part(s) and related labor. Manufacturer's written guarantees shall be provided where it is published.
- B. Any obvious defects shall be corrected before final acceptance. For additional defects after final acceptance, the Owner shall advise the Contractor in writing, unless the situation is urgent, to address the deficiency or malfunction. The Contractor shall respond promptly and with no additional compensation for a valid guarantee claim.
- C. Longer guarantee periods of time or special conditions may be specified. See particular specifications for these requirements.
- D. If a written guarantee is offered for conditions or period exceeding specified requirements; this guarantee shall be included in the "Close-out" specifications of Subsection 26 00 48.

2. Single manufacturer named followed by “or approved equivalent”: The design has been based on this particular make and model for acceptable physical characteristics, performance and quality. Any other comparable and equivalent product may be substituted in accordance with procedures for submittals and approvals (Subsection 26 00 43) and conditions of Subsection 26 00 62, Equipment substitution.
 3. Limited multiple manufacturers named: The design has been based on the first named manufacturer for acceptable physical characteristics, performance and quality. Any one of the other limited named manufacturers is equally acceptable in quality and may be substituted in accordance with procedures for submittals and approvals (Subsection 26 0043) and conditions of Subsection 26 00 62, Equipment substitution.
 4. Limited multiple manufacturers named followed by “or approved equivalent”: The design is based on the first named manufacturer for acceptable physical characteristics, performance and quality. Any one of the other limited named manufacturers is equally acceptable in quality and along with other comparable and equivalent product may be substituted in accordance with procedures for submittals and approvals (Subsection 26 00 43) and conditions of Subsection 26 00 62, Equipment substitution.
 5. List of “Acceptable Manufacturers”: Where a specific product from a manufacturer is listed along with the words “Acceptable Manufacturers” and a list of manufacturers this equal product(s) of any of the limited list may be submitted without concern from Subsection 26 00 62.
- B. The Contractor shall follow the option specified from above as applied to each respective material and equipment specification subsection. The Contractor shall indicate within the options allowed the respective supply source(s) for the listing requested in Subsection 26 00 43. The Contractor shall assume all responsibilities and liabilities of “or equivalent” substitutions (see Subsection 26 00 62).
- C. The Contractor shall prepare and transmit submittals for approval, even for the option of Subsection 26 00 61.1.

26 00 62 EQUIPMENT SUBSTITUTION

- A. General: As previously stated, the design has been based on a single manufacturer and model. Substitution, where permitted (as described above), may cause consequential effects that may impact on the Project. These effects may take various forms and may require changes in the design. These changes and any additional costs associated therewith are the responsibility of the Contractor proposing the substitution; no additional compensation shall be provided to the Contractor.
- B. A possible change in design may result from the proposed substitution from one or more of, but not limited to, the following conditions:
1. Architectural: different physical configuration, size or fit, aesthetics effected.
 2. Structural: different bearing or heavier loading.
 3. Capacity: different performance, lesser output is unacceptable.
 4. Mechanical: change in flow rates (air, water, etc.), different configuration and size of external piping or ductwork connections.
 5. Electrical: different horsepower requirements, effect on distribution.

6. Controls: interconnections with control devices and equipment, additional requirements.
7. Impact on environmental or energy efficiency issues.
8. Departure from intent of original design or Project Documents.
- C. Changes in loading, sizing and/or performance of the proposed substitution shall consider the total requirements served or needed by the particular equipment. A revised design to accommodate the substitution shall be extended to the point where the change has no effect on the parameters used in the original design.
- D. An equipment substitution requiring a change in the design shall be processed as follows:
1. The Contractor shall prepare and submit to the Architect/Engineer for review, a proposal to provide a substitution that shall require a change in the design. Substantiate that the substitution complies with the intent of the Project Documents and include sufficient information of the changes required so that a judgment may be rendered.
 2. Proposal shall include an original drawing originated by the Contractor, and shall not be a catalog cut, assembly manual, or other generic documented printed by the manufacturer or their representative. The design shall show the intended installation to the same level of detail as that of the original design.
 3. Prior to submitting the proposal, the Contractor shall notify all other contractors whose work may be affected and request details and pricing for their respective changes. This information along with the Contractor's details shall be transmitted to the Architect/Engineer for approval.
 4. The Contractor in preparing the proposal recognizes that they shall compensate other trades that are affected by said proposal.
 5. If the proposal and the substitution are acceptable, the Architect/Engineer will approve the submittal and initiate a change order, at no additional compensation, and a notice to proceed.
- E. Equipment that was listed as a multiple manufacturer with a model number shall be submitted as a shop drawing. Contractor shall be responsible for all other provisions of Section 26 00 52. If, and only if, the material or equipment substitution requires no design change, the Work shall proceed in accordance with the Product Documents.
- F. Equipment that is being proposed as 'or equivalent' or was listed as a multiple manufacturer without a model number shall be in the form of a written proposal before the shop drawing phase. 'Or equivalent' shall mean or equivalent in the opinion of the Architect/Engineer and they shall have sole discretion to determine whether or not a proposed substitute manufacturer and/or model is to be considered as acceptably equivalent and may be submitted in the form of shop drawings. If, and only if, the material or equipment substitution requires no design change, the Work shall proceed in accordance with the Project Documents.
- G. If changes are in fact required or a delay in work occurs because of the material or equipment substitution which were not properly processed, the Contractor initiating the substitution shall be liable for all consequential effects and expenses to accommodate the change or delay.

26 00 64 ACCESS DOORS

- A. Openings in building components for access to concealed mechanical work shall be furnished by the Contractor and installed with the building construction work. Access doors shall be located as indicated on the Plans or as strategically required for inspection, maintenance, and service. The model and style shall fit the building construction, fire rating requirements and provide adequate size and function.
- B. Access doors shall be sized as shown on the drawings or shall be a minimum size of 18" x 18" and otherwise shall be large enough for purpose intended and shall be fabricated of heavy gauge steel frames and door panels with double action concealed spring hinges, 1/4 turn flush screwdriver operated cam locks and prime coat paint finish. Access doors for various applications shall be as follows:
- | <u>Building Construction:</u> | <u>Milcor Access Door:</u> |
|---|---------------------------------------|
| Flush door in dry wall construction (walls and ceilings) | Style DW |
| Flush door in masonry or tile walls with exposed frame flange | Style M (steel), Style MS (stainless) |
| Flush door in plaster construction (walls and ceilings) | Style K |
| Recessed door in acoustical plaster ceiling | Style AP |
| Recessed door in suspended drywall ceiling locations) | Style CT (aluminum - wet |
| Flush door in suspended drywall ceiling locations) | Style CF (aluminum - wet |
| Door in suspended drywall ceiling | Style ATR (fire resistive door) |
| Fire rated separation (walls and ceilings) - fire rated door | |
- C. Access doors are not required for Work above lay-in panel ceilings.
- D. Submittals shall indicate schedule of locations, sizes, types, adjacent building construction, finish, fire rating including thickness and type of insulation, conformance to UL requirements and associated labeling, metal and gauge of fabrication. Access door shall be as manufactured by Karp Associates, Milcor, or Higgins Mfg. Company.

26 00 70 BASIC ELECTRICAL METHODS - GENERAL

26 00 71 COORDINATION OF WORK

- A. The Contractor shall compare the electrical drawings and specifications with the site conditions, drawings and specifications of other trades and shall report any discrepancies between them to the Architect and obtain from him written permission for changes necessary in the electrical work. The Contractor at no addition to the contract price shall perform any such changes required. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor shall make proper provisions to avoid interference in a manner approved by the Architect. All changes required in the work of the Contractor caused by his neglect to properly coordinate the work shall be made by him at his own expense.
- B. In new construction, anchor bolts, sleeves, inserts and supports required for the electrical work shall be furnished under the same Section of the Specifications as the respective items to be supported; and they shall be installed, except as otherwise specified, by the trade furnishing them in cooperation with the trade furnishing and installing the material in which they are to be located. It shall be the responsibility of the Contractor who locates the anchor bolts, sleeves, inserts and supports to also ensure that they are properly and safely installed.

- C. Slots, chases, openings, and recesses through floors, walls, ceilings, partitions, and roofs shall be provided as the building is erected. It shall be the responsibility of the Contractor or trade requiring and providing the opening to verify the size and location of openings required and to furnish necessary sleeves, boxes, etc., for the equipment to be supplied. Patching of oversize openings and finished thereof shall be the responsibility of the trade or Contractor requiring the opening. All patching and finishing shall be done to match the adjacent materials as described in other respective divisions and sections of the specifications. No openings shall be cut in structural members without prior written approval of the Architect.
- D. Locations of conduits, electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The Contractor shall determine the exact route and location of each conduit, duct and electrical raceway prior to fabrication. If the Contractor fails to do so, any relocation and reinstallation required will be directed by the Architect and must be implemented by the Contractor at no cost to the Owner.
- E. Right-of-way: Lines which pitch shall have the right of way over those which do not pitch. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed. Offsets, transitions and changes in direction in pipes and buss ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all elbows, pullboxes, turns, fittings, supports, etc., as required to affect these offsets, transitions and changes in direction.

26 00 72 STORAGE AND INSTALLATION OF EQUIPMENT AND ACCESSORIES

- A. Equipment and materials shall be delivered to the site, stored in location(s) approved by the Architect, and suitably sheltered from the weather, but readily accessible for inspection by the Owner. All items subject to moisture damage shall be stored in dry, heated spaces. All equipment shall be covered and protected against dirt, water and chemical or mechanical injury in a manner approved by the manufacturer and against theft, during storage, installation, and construction. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.
- B. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation of all equipment and materials. The Contractor shall promptly notify the Architect in writing of any conflict between any requirement of the contract documents and the manufacturer's directions. They shall obtain the Architect's written instruction before proceeding with the work. In case of a difference between the installation instructions of the manufacturer and the instructions in the contract documents, the most stringent shall govern. Any costs related to changes required due to manufacturer's instructions differing from the contract documents shall be borne by the Contractor at no cost to the Owner.
- C. Should the Contractor perform any work that does not comply with the manufacturer's directions, any written instructions from the Architect, or which shall cause a significant deviation from the drawings which has not been by the Architect they shall bear all costs arising in correcting the deficiencies in a manner directed by the Architect.
- D. Where switchgear, motor controls, transformers, or other electrical equipment is located in a space with a concrete or other type of paved flooring, it shall be set on a raised concrete pad. Unless otherwise noted on drawings or elsewhere in these specifications, concrete pads and bases shall be furnished and installed by the Contractor furnishing the equipment. This Contractor shall establish sizes and location of the various concrete bases required and shall provide all necessary anchor bolts together with templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with a suitable plate at bottom end of sleeve to hold the bolt. Each concrete base shall be not less than 3" high,

unless noted otherwise, which shall project not less than 1-1/2" beyond the equipment and not less than 3" beyond anchor bolts on all sides.

- E. Where equipment is located in a space where it does not rest on a concrete or similar paved floor, it shall be supported from or on the available structure on a structural frame made of suitable channels, wide flange members or angles. The structural frames shall allow no deflection with the loads imposed and the respective supporting points, shall distribute the load equally to two or more major building structural elements, and shall be designed to carry all loads into the major building structural members, creating no measurable deflection on these members nor importing any vibration into the building structure.
- F. All machinery which contains rotating or reciprocating parts or which is connected to other machinery with such parts shall be provided with vibration isolation mounts which shall be selected at a maximum transmissibility of 0.03 (isolation efficiency of 97%) at the lowest anticipated operating speed of the device.
- G. The Contractor shall support plumb, rigid and true-to-line all work and equipment furnished under each section. The Contractor shall study thoroughly all general, structural, mechanical and electrical drawings, shop drawings and catalog data to determine how equipment, fixtures, etc., are to be supported, mounted or suspended and shall provide steel bolts, inserts, pipe stands, brackets, and accessories for proper support whether or not shown on drawings. When directed by the Architect, the Contractor shall submit drawings showing supports for approval.
- H. All conduit connecting to switchgear, panels, motors, and other equipment shall be installed without strain at the connections. The Contractor may be required, as directed, to disconnect conduits piping to demonstrate that they have been so connected.
- I. The Contractor shall install all electrical work to permit removal (without damage to other parts) of switches, contactors, motors, drawout circuit breakers, belt guards, sheaves and drives and all other parts requiring periodic replacement and maintenance. The Contractor shall provide conduits, pullboxes, junction boxes, bus ducts, switchgear, raceways and equipment to permit ready access to components and to clear the openings of swinging and overhead doors and of access panels.
- J. The Contractor shall change the routing of conduits and buss ducts when required to meet job conditions. The Contractor shall secure approval of Owner prior to fabrication of equipment requiring such changes.

26 00 80 BASIC ELECTRICAL METHODS – RELATED WORK

26 00 81 DEMOLITION

A. Work Included:

1. The Owner shall keep possession of the designated equipment, including switchgear, transformers, motors, generators, panelboards, light fixtures, etc., as shown on the Plans, or as indicated during construction, or as hereinafter specified. The Contractor shall deliver, off-load and store this property as directed by the Owner. Machinery components not to be retained by the owner, including the above type of equipment and conduit, wire, hangers, brackets, insulation, wiring devices, etc., must be disconnected and removed from the premises, to be disposed of by the Contractor.
2. Contractor shall disconnect and remove all existing machinery, equipment, and apparatus to the extent shown on the drawings or otherwise described herein.

3. The Contractor shall legally dispose of the designated equipment, and/or apparatus. Any cost of removal or salvage value shall be credited to the Contractor's account and shall be considered accordingly in the Contractor's bid.

B. Work Not Included:

1. The removal and disposal of asbestos based insulation or other hazardous materials applied to, or contained in, the mechanical equipment, and material designated to be demolished shall not be included in the scope of the work regardless if known ahead of time or discovered in the course of performing the Work. In the latter case, the Contractor shall notify the Architect/Engineer and shall not pursue that portion of the Work until others have removed the asbestos-based material. The removal and disposal of asbestos-based material shall be arranged by and to the account of the Owner and conducted separately from the demolition work.

C. Miscellaneous:

1. Where items are specifically identified to be abandoned, all loose ends of the system shall be trimmed clear and appropriately capped or sealed in a safe and secure manner as approved by the Architect/Engineer.

26 00 82 CUTTING AND PATCHING

- A. The basic premise of this Sub-section is that the cutting and patching (where required) are performed in existing building components. In "new" construction, the premise is that the building component is already in place.
- B. The Contractor requiring the penetration of or the access way in the building structure to fulfill the intent of the Project Documents for his Work shall be responsible for the cutting and the subsequent patching in accordance with the following criteria:
1. No structural component of the building shall be cut or violated without express approval of the Architect/Engineer.
2. The Contractor shall verify the presence of any concealed utility or service within the structure (walls, roof, floor, etc.) in question, and shall be responsible for maintaining continuity and/or replacing it.
- C. Cutting of work-in-place in "new" construction because of error, neglect or damage inflicted shall be the responsibility of the Contractor precipitating the issue.
- D. "Patching" shall be construed as the repairing or replacing of the building structure to return it to an original or new condition, in the opinion of the Owner and/or Architect/Engineer, as existed prior to the cutting.
- E. Patching and finishing work shall be the responsibility of the Contractor requiring the cutting. The patching shall match all the substantive and visual aspects of the structure and adjacent surfaces. Restoration and finishes shall be as specified and executed in the respective sections, schedules and/or details of the Project Documents for the general construction work. Completed work and any special requirements shall be subject to approval by and satisfaction of the Architect/Engineer.

26 00 90 TESTING AND ADJUSTING

26 00 91 INSTRUCTIONS OF OWNER'S REPRESENTATIVE

- A. Instruct the designated representative of the Owner in the proper operation and maintenance of all elements of the electrical systems. A competent representative of the Contractor shall provide such formal instruction and shall spend such additional time as directed by Architect/Engineer to fully prepare Owner to operate and maintain the electrical systems.

26 00 92 TESTING AND ADJUSTING

- A. Contractor shall, at the conclusion of the project, performance test and adjust all of the electrical systems to provide performance of all systems and subsystems installed and in all areas of the building. All power systems, communication systems, control systems and other related devices and subsystems shall be operated by the Contractor for a period of no less than seventy-two (72) hours and shall be systematically tested for proper sequencing, control, connection, phasing, rotation and calibration of control devices.
- B. Testing shall be systematic and thorough, and the results of these tests shall be submitted to the Architect/Engineer prior to final acceptance of the work. The format of this testing and adjusting effort, including all measurement techniques and methods, shall be submitted sixty (60) days prior to the completion of the work. After agreement with the Architect/Engineer on the format of the testing and adjusting work, the Contractor shall perform the work and resolve any and all deficiencies as they appear during the testing. It shall be the responsibility of the Contractor to provide any and all devices required for the successful testing and adjusting of the system.

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

- A. Extent: The work in this division consists of furnishing material and labor required to completely execute the electrical work for this project as per drawings and as specified herein.
- B. Interface with Other Trades: This contractor shall connect some items furnished in place by others such as prewired mechanical control assemblies. This will require coordination and cooperation with the other contractors. The extent of the required electrical work is shown on the drawings.

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- A. Material
 - 1. Provisions for Wiring: Wire and cable of the sizes and types shown on the plans and/or hereinafter specified shall be furnished and installed by the Contractor. All wire and cable shall be new soft drawn copper and shall conform to all the latest requirements of the National Electrical Code IPCEA, and meet the specifications of the ASTM.
 - 2. Power Conductors: All feeder and branch circuit wire shall be 600V 90°C insulated of the THHN & THWN-2 type unless shown or specified to be otherwise No wire less than No. 12 AWG shall be used except for control circuits or low voltage wiring. All wire sizes shown are American Wire Gauge sizes.
 - a. 20A Branch Circuit Homeruns shall be sized as follows:

120V: 0 – 100 feet shall be #12AWG wire minimum

101 – 200 feet shall be #10AWG wire minimum
In excess of 200 feet shall be #8AWG wire minimum
277V: 0 – 250 feet shall be #12AWG wire minimum
In excess of 250 feet shall be #10AWG wire minimum

3. Where conductors are upsized to account for deratings or voltage drop and are too large for the termination lugs, provide reducer pins equivalent to Burndy AYP or AYPO (offset pin). Reducer pins shall be compression type, dual rated for aluminum/copper conductors, and include an insulating cover.
4. Control Conductors: Control circuit wiring shall be No. 12 AWG or smaller stranded wire. Stranded control wire shall be provided with crimp type spade terminators. Control circuit wiring shall be color-coded or numbered using an identical number on both ends of the conductor.

B. Installation

1. All 120V and 277V single phase circuits require a dedicated neutral conductor. The neutral conductor shall be numbered and identified with associated phase conductor at the panelboard as well as all junction boxes.
2. Where circuit runs are combined, upsize conduit and conductors to accommodate for conduit fill and conductor derating respectively.
3. Metal Clad (MC) Cable
 - a. Type MC cable is permitted for wiring the final portion of light fixture branch circuits from fixture to fixture within a room or area. The MC cable may be supported by the light fixture bracing wires but shall not be supported by the ceiling grid support wires. Type MC cable is permitted for wiring from local distribution junction boxes to devices or equipment in nearby walls or ceiling space. The local distribution junction boxes should be located within 20 feet of the device or equipment served. Conduit and wiring shall be used for branch circuiting between the local distribution junction boxes and for the "homeruns" from the panels. Type MC cable is permitted to route from receptacle to receptacle through walls and through the ceiling space for the final portion of branch circuit wiring between receptacles in adjacent walls of the same room or area. Type MC cable shall not be installed where exposed.
4. BX/AC Cable
 - a. **Type BX/AC cable is not permitted.**

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Material

1. **Contractor shall extend the existing equipment grounding system in accordance with the National Electrical Code and shall use only UL listed grounding clamps and connectors.**

B. Installation

1. The grounding system grounding electrode conductor shall be connected to the neutral bar inside the main panel.

26 05 33 RACEWAY FOR ELECTRICAL SYSTEMS

A. General Requirements

1. Minimum conduit size shall be ¾" trade size for branch circuits
2. A bushing shall be used where conduit enters a panel box or equipment enclosure.
3. Grounding Bushings shall be used to bond conduits entering a panel box or equipment that are not mechanically connected.
4. All raceways for equipment and devices located within or on the building are to be routed through the interior of the building. Do not route conduits on the roof, surface mounted on the building exterior walls or via exterior trenches or directional bores between areas of the building, unless noted otherwise or prior approval is provided by the Architect/Engineer.
5. Expansion fittings shall be provided at all conduits across building expansion joints. Fittings shall be Type "AX" or "TX" as made by O-Z Electric Company, or approved equal. Provide copper bonding jumper at each expansion fitting.
6. Conduit bends shall be made with standard benders of proper size; radius of bends to be at least 6 times the diameter of the conduit. Runs between outlets shall not contain more than the equivalent of three 90-degree bends. Conduit runs shall be continuous from outlet to outlet, outlet to cabinet, etc.
7. All exposed conduits shall be installed parallel or perpendicular to the building walls or floors.
8. Conduits shall be securely fastened to or supported from the building structure. Conduits not fastened directly to building structure shall be supported by a rigid assembly, free of sway and adequately braced, connected directly to the building structure. The use of 'pencil' wire, ceiling wire, and cable hangers shall not be permitted.
9. Anchor or stake down all direct burial conduits to prevent shifting during grading and concrete pours. Spacers shall be provided for trenches with 2 or more conduits with any conduit 2" or larger.
10. Install #12AWG pull wires for tracing for all underground non-metallic empty conduits with a minimum of 12 inches of slack on each end. Pull strings shall be used for empty above grade or metallic conduits.
11. All raceways installed within 1½" of the roof deck shall be GRS or IMC. Boxes shall be offset below the 1½".
12. All exposed raceways installed in a finished space will be painted to match the background, unless noted otherwise. Finished spaces include all areas open to the general public. Spaces such as storage, mechanical, IT, and electrical rooms and other similar areas only accessible to qualified personnel are considered unfinished.

13. All penetrations through not rated walls shall be sealed for draft stopping with caulk, putty, etc. designed for this use.
14. Fire / Smoke seals:
 - a. All penetrations through fire rated walls and floors shall be fire sealed in accordance with ASTM E814/UL1479 or manufacturer's recommendations.
 - b. Materials and installation details shall be submitted for approval.
- B. Electrical Metallic (EMT) Conduit
 1. EMT conduit shall be installed for all work concealed in partitions or in concrete block walls and for all conduits run in ceiling plenums and exposed runs, except where noted otherwise. Aluminum EMT is not approved. EMT conduit shall not be used outdoors, in wet locations, in floor crawl spaces, or below 7' AFF.
 2. EMT couplings and connectors shall be steel compression type.
- C. Galvanized Rigid Steel (GRS) Conduit
 1. Galvanized rigid steel conduits shall be installed for all exposed outdoor conduit, and for all indoor medium voltage cable runs,
 2. All GRS couplings and threaded hubs shall have no less than five threads of the coupling engaged. Running threads shall not be used. All GRS conduits shall be reamed.
 3. All GRS conduits shall have two locknuts and a bushing at each termination outlet box, junction box, etc., except where terminated in a threaded hub.
- D. Rigid Aluminum Conduit
 1. Rigid aluminum conduits are approved only as directed by the engineer.
- E. Polyvinyl Chloride (PVC) Conduit
 1. PVC Conduits are approved only as directed by the engineer.
- F. Liquid-tight Flexible Steel Conduit
 1. Liquid-tight flexible steel conduit ('Sealtite') shall be used in wet areas where flexible conduit connections are required and on all motorized equipment and motors in all locations.
 2. Liquid-tight flexible metal conduit ('Sealtite') is not permitted for roof penetrations.
- G. Flexible Steel Conduit
 1. Flexible steel conduit ('Greenfield') shall be used where vibration isolation is required, including all transformers and uninterruptible power systems.
- H. High Density Polyethylene (HDPE)

1.Type HDPE Schedule 40 Conduits are approved only as directed by the engineer

26 05 34 BOXES FOR ELECTRICAL SYSTEMS

A. Outlet Boxes, Junction Boxes, Fittings

- 1.Mounting: Outlets must be centered with regard to paneling, furring, trim, etc. Outlets shall be set plumb or horizontal and shall extend to finished surface of wall, ceiling, or floor without projecting beyond or behind finished surface. Outlet boxes shall not be installed “back-to-back”.
- 2.Attaching: Boxes shall be attached by fastener designed for the purpose and shall provide adequate mechanical strength for future maintenance.
 - a. Boxes installed in metal stud partitions shall be secured to the metal studs using appropriate clips, fasteners, hangers, or supports as required, and shall provide adequate far side box support to fulfill the intent of all applicable codes.
- 3.Pull boxes and junction boxes shall be installed where indicated on the drawings or where required to facilitate wire installation.
 - a. Size: Outlet, junction, and pull boxes not dimensioned shall be 4-inch square by 2-1/8” deep minimum and comply with sizing as required by Article 314 of the National Electrical Code.
- 4.In fire rated drywall walls, 24” spacing must be maintained between boxes on opposite sides of walls. Moldable fire protective putty pads, firestopping coverplate gaskets, internal fire rated pads or other acceptable fire sealing means shall be installed on outlet boxes where the 24” spacing cannot be maintained.
- 5.Steel faceplates must be used on fire rated drywall walls and painted to match device color. Faceplates shall be Mulberry Metal Products or equivalent.
- 6.All outdoor junction boxes and condulets shall be gasketed.
- 7.Handholes shall be installed where indicated on the drawings or where required to facilitate wire installation.
 - a. Handholes not dimensioned shall be 12 inch by 12 inch by 12” deep minimum with open bottom and comply with sizing as required by Article 314 of the National Electrical Code. Handhole to be gasketed. Install on a minimum 6” gravel base with top of handhole flush with grade. Manufactured by Quazite or equivalent.
 - b. Bolted style cover with gasket to match handhole. Include with “Electric” logo, unless noted otherwise.
 - c. Handhole and handhole cover to be rated as Tier 15 loading.

26 05 48 SEISMIC RESTRAINT

- A. All materials and workmanship shall specifically comply with the above listed Building Code with respect to seismic requirements for the support and anchorage of all electrical,

communications and electronic safety and security systems and equipment as installed on this project. Lateral forces to be restrained shall be as required by IBC Section 1621 Architectural, Mechanical, and Electrical Component Seismic Design Requirements and ASCE 7-02 Section 9.6 Architectural, Mechanical, and Electrical Components and Systems with the following design parameters:

1. Site Class as Defined in the IBC: **C**.
 2. In subparagraph below, retain Seismic Use Group or Building Category for Project structure from three classifications defined in the IBC.
 3. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
- B. All conduit support and restraint details and practices shall conform to the publication “Seismic Restraint Systems Guidelines” by Cooper B-line-TOLCO.
- C. Seismic restraint submittals shall be provided for engineer review and include, but not be limited to, detailed drawings showing seismic restraint types, anchor type and attachment details, calculations and spacing requirements of unique equipment and conduit for this specific project. Submittals shall include floor plan drawings indicating equipment, ductwork and piping to be restrained, restraint locations and restraint component types. All submittals and floor plan drawings shall bear the seal of a licensed structural engineer of the State of Missouri.

26 09 00 INSTRUMENTATION AND CONTROL FOR ELECTRICAL SYSTEMS

26 09 23 LIGHTING CONTROL DEVICES

A. OCCUPANCY SENSORS

1. Ceiling mounted occupancy sensors shall be dual-technology and white in color unless otherwise noted: Watt Stopper #DT-300, Hubbell #OMNI-DT-1000, Leviton #OSC10-MOW, Sensorswitch #CM-PDT-9, Lutron LOS-LDT-1000-WH or approved equivalent.
 - a. Sensors shall be programmed to the following time delays:
 - I. Open Offices/Classrooms – 30 minutes
 - II. Bathrooms – 10 minutes
 - III. Conference Rooms – 5 minutes
 - IV. Corridors – 5 minutes
2. Wall mounted occupancy sensors shall be dual-technology and **white/ivory** in color: Watt Stopper #DT-200, Hubbell #LODT, Leviton #OSW12-RMW, Sensorswitch #WV-PDT-16, Lutron LOS-WDT-WH or approved equivalent.
 - a. Time delays – Refer to ceiling mount occupancy sensors.
3. Wallswitch occupancy sensors shall be **white/ivory** in color and be Watt-Stopper #DSW-100, Hubbell #LHMTS1, Leviton #OSSMD, Sensorswitch #WSD-PDT, Lutron MS-B102 or approved equivalent.

- a. Sensors shall be programmed to the following time delays:
 - I. Offices – Adaptive if available, otherwise 30 seconds, walk-through enabled
 - II. Conference Rooms – 5 minutes, walk-through enabled
 - III. Storage Rooms – 30 seconds, walk-through enabled
 - IV. Wall Switch Occupancy Sensor Dimmer shall be **white/ivory** in color and be Wattstopper #DW-311, Lutron MS-Z101-XX or approved equivalent. Time delays – Refer to wallswitch occupancy sensors.

4. Dual relay wall switch occupancy sensors shall be white/ivory in color and be: Wattstopper #DW-200, Hubbell #LHMTD2, Leviton #OSSMD, Sensorswitch #WSD-PDT-2P, Lutron MS-B202 or approved equipment.

- a. Time delays – Refer to wall switch occupancy sensors.

5. Provide occupancy sensors with relay packs as required or shown on the drawings.

6. Occupancy sensors shall be programmed to 'manual-on' unless otherwise specified.

7. Provide open plenum rated wiring in accordance with manufacturer's wiring diagrams.

8. Rooms or areas with multiple sensors shall be wired so that any sensor activates all lights.

9. Sensors shall be installed a minimum of 6' from all diffusers.

10. Refer to wiring diagrams on drawings for additional requirements.

B. DIGITAL COUNTDOWN TIMERS

1. WattStopper TS-400, Leviton 61244 Digital Countdown Timer or approved equivalent.

2. Countdown Timer to be programmed to the following:

- a. Storage Rooms – 5 minutes with audio and visual options disabled.
- b. Mechanical/Electrical Rooms – 20 minutes with audio and visual options enabled.

C. DIMMERS

1. Provide dimmer switches as shown on drawings.

2. Contractor is responsible for providing and installing dimmer compatible with LED driver of fixtures.

3. Dimmers to be manufactured by WattStopper, Hubbell, Leviton, Sensorswitch, Lutron or approved equivalent.

4. 0-10V LED dimmers requiring 'manual-on' shall be WattStopper #DLV2 or approved equivalent.

A. SYSTEM

1. Furnish and install a complete low voltage lighting control system consisting of relay control panels, switches and wiring to provide control as shown on the drawings.
2. Manufacturer shall submit specific connection diagrams and riser diagrams related to this project for approval.
3. System shall be a 'Greenmax' Lighting Control System as manufactured by Leviton or *equivalent*.
 - a. System shall be furnished with a handheld display unit for system programming and time clock functions.
4. System shall be networked to allow complete system control from any switch location.
5. Contractor shall program system as shown in contract documents.
 - a. Contractor shall furnish panel directories indicating circuit designation, and area designation for each relay.
 - b. Contractor shall furnish the following as operating and maintenance manuals:
 - I. Installation and programming instructions for all system components.
 - II. Operating instructions for all system components.
 - III. Relay schedule documentation.
 - IV. Switch schedule documentation.
 - V. Time Clock schedule documentation.

B. Relays

1. Relays shall be mounted in control panels containing terminal strips, transformers, rectifiers, all interconnecting wiring and switch interface modules for multiple relays. Relays shall maintain position during power outages.
2. Low Voltage Relays shall be Greenmax relay modules with manual by-pass or equal.

C. Switches

1. Switches shall be 4-wire bus controlled. The 4-wire bus shall be designed for open topology.
2. Switches shall have typed labels indicating fixtures controlled per the drawings.
3. Switches shall have LEDs indicating on/off status.

4. Switches shall be capable of being configured to control a single relay, a group of relays, or pattern control.
5. Lighting Switches shall be Leviton Greenmax switches as indicated on the drawings, or equivalent.

D. Wiring

1. All wiring shall be as required by the equipment supplier.
2. Wiring may be run as concealed open-type plenum rated cable. Exposed or inaccessible wiring shall be installed in conduit. Where possible wiring/conduit shall be concealed.

E. Testing and Checkout

1. The Contractor shall provide a representative from the company to conduct a 4-hour training class at a time scheduled in advance with the Owner and shall occur during or immediately following system startup. These instructions are to be conducted during normal working hours. All pertinent costs shall be included in this contract.

26 20 00 LOW-VOLTAGE ELECTRICAL TRANSMISSION

A. SHORT CIRCUIT RATINGS

1. All short circuit ratings shall be Fully Rated device ratings, not Series Rated.

26 24 00 SWITCHBOARDS AND PANELBOARDS

26 24 16 PANELBOARDS

A. DISTRIBUTION PANELBOARDS:

1. Panelboards shall be installed as shown on the drawings and specified below.
2. Panels shall be dead front type, with fusible switches or circuit breakers furnished in sizes as indicated on drawings.
3. The panels shall include an equipment grounding bus.
4. Main buses and connectors shall be copper of sufficient current carrying capacity to limit the temperature rise to 65KC per UL tests and have a minimum short circuit rating of 14,000A (120/208V) or as noted on the drawings.
5. All protective devices installed in the distribution panelboard shall have a kAIC rating to match the distribution panelboard kAIC rating unless otherwise noted.
6. All main bus joints, tap connections, and contact points shall be silver or tin-plated.
7. Provide a 6" wide x 2" high phenolic switchboard nameplate reading the following:

PANELBOARD IDENTIFICATION	(5/8" Lettering)
___V ___Ph ___W ___A	(3/8" Lettering)
___kAIC FULLY RATED	(3/8" Lettering)

FED FROM _____

(3/8" Lettering)

8. Provide labeling indicating Available Fault Current with calculation date Per NEC 2020 408.6.
9. Fusible Switches and Circuit Breakers: Fusible switches and circuit breakers shall be provided in the sizes and arrangements shown on the drawings. Fusible switches shall accept Class R fuses. Provide a 3" wide x 1" high phenolic nameplate for each switch as follows:

EQUIPMENT IDENTIFICATION

(3/8" Lettering)

__AS/ __AF (XX AMPS WITH/XX AMP FUSE)

(1/4" Lettering)

- a. The switches shall be provided with a door interlock to prevent access to fuses and switch when energized and manually operated interlock defeat mechanism. The door is to be furnished with "on-off" handle position markings and a means to lock the switch in the open position is to be provided.
10. Manufacturer: The panelboard shall be as manufactured by Siemens, Square D Company, General Electric by ABB, or Eaton Cutler Hammer.
 11. Refer to Section 20 00 72 for support of equipment and "housekeeping pad" requirements.

B. CIRCUIT BREAKER PANELBOARDS

1. Panels shall be dead front, safety type, furnished with branch circuit protecting devices, equipment grounding bus, phenolic nameplate, main bus and cable lugs factory assembled, with all components in place, ready for installation. Contractor to determine top or bottom feed for lug placement. Feed locations shall not be reviewed by the Engineer.
2. The circuit breakers shall be of the molded case, bolt-on type suitable for voltage and ampere ratings indicated on drawings and in schedules and shall have a minimum interrupting capacity of 10,000 amperes (120/208V) or 14,000 amperes (277/480V) or as noted on the drawings.
3. Provide lockable red circuit breakers on all circuits serving the fire alarm system.
4. Buses and connectors shall be silver or tin plated hard drawn copper of 98% conductivity, with current carrying capacity to maintain established rise tests as defined in UL Standard UL 67.
5. A directory frame shall be attached to inside face of hinged door. The directory card shall be neatly typed to identify circuits. A transparent plastic facing shall protect the directory card. Room numbers shall be included in directory descriptions. Furnish a copy of each panel directory to the Architect/Engineer. Where existing panelboard loads are modified, the panel directories shall be updated.
6. All flush mounted panelboards shall have spare 1" conduits stubbed up out of the panelboard and extended to above an accessible ceiling. Panelboards in interior wall shall have two conduits stubbed out on both sides of the wall (four conduits total). Panelboards in exterior walls shall have three conduits stubbed out into the building interior.

Quadplex	NP82I	80716-I	5150V	TP82-I
Single Toggle	NP1I	80701-I	5134V	TP1-I
2-Gang Toggle	NP2I	80709-I	5139V	TP2-I
GFI	NP26I	80401-N1	5151V	TP26-I

Weatherproof Plates

WP GFI	NWP26	6196-V	1966	WP26-I
WP In Use GFI	Bell MX4280(Z-bronze,WH-white,S-gray)			

Locking Plates

Single Gang	FSR WB-MS1G
Two-Gang	FSR WB-MS2G
Three-Gang	FSR WB-MS3G
Four-Gang	FSR WB-MS4G

- C. All receptacles and switches shall be identified with a black-on-clear printed adhesive label affixed to the coverplate. This label shall include the panel and branch circuit number supplying power to the receptacle.

26 28 00 LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

26 28 16 DISCONNECT SWITCHES

- A. Type of Switch: Furnish and install disconnect switches as specified where shown on the drawings.

- All disconnect switches shall be classed Heavy Duty and enclosed as required by NEMA Standards. Switch sizes and fusing shall be as shown on the drawings.
- Switch shall have a quick make, quick break mechanism operating through the box and not the cover. The switchblades shall be visible when the hinged door is open.
- The cover shall be interlocked with the operating handle to prevent opening door when switch is "ON" and a means provided to lock switch in the "OFF" position. This mechanism shall be capable of being defeated.
- Provide a 4" wide x 1½" high phenolic nameplate reading the following for each switch:

'EQUIPMENT IDENTIFICATION'	(3/8" Lettering)
SERVICE DISCONNECT	(3/8" Lettering)
FED FROM 'SOURCE NAME'	(1/4" Lettering)
LOCATE IN 'SOURCE LOCATION'	(1/4" Lettering)

- B. Manufacturer: Switches shall be by Siemens, Square D, Eaton Cutler Hammer, or General Electric by ABB.

26 29 00 LOW-VOLTAGE CONTROLLERS

- A. CONTROL AND INTERLOCK WIRING

- The Electrical Contractor shall furnish and install control and interlock wiring as shown on the electrical drawings. Control and interlock wiring required by Division 22 or 25 but not

shown on the electrical drawing shall be the responsibility of the Division 22 or 25 Contractor requiring the wiring.

2. Generally, this will mean that Division 26 wires the series safety circuit to the magnetic starters, furnished with Hand-Off-Auto selector switches, using switches and devices furnished by the Mechanical Contractor.
3. Starter automation, as required by the temperature control sequence of operation, will be provided and wired by Division 22 or 25 with connections made to terminals on the automatic side of the selector switch and on starter coil auxiliary contacts.
4. The intention is that Division 26 furnish and install all wiring necessary to operate the magnetic starters with the selector switch in the Hand position and that Division 22 or 25 provide all additional automation required.
5. Relays, electropneumatic relays, and any other device required by Division 22 or 25 to operate in parallel with the starter coil shall be controlled through spare auxiliary contacts on the starter furnished by Division 26 and shall not be connected to the starter coil.
6. Single-phase motors generally are controlled by line voltage controllers furnished by the Temperature Control Contractor but installed by the Electrical Contractor. If the control sequence is more complicated than a single line voltage device such as a unit mounted thermostat, a relay or control device with a horsepower rated contact will be provided by the Temperature Control Contractor for installation by the Electrical Contractor adjacent to the motor disconnect device. The Electrical Contractor shall provide power-wiring connections to this control device. Temperature Control Contractor will provide control and interlock wiring to this control device.

26 29 13 MOTOR AND APPLIANCE CONTROL

- A. Electrical Contractor shall furnish and install all electrical devices incident to the work except as otherwise stated herein. The Mechanical Contractor will furnish prewired control panels for equipment so indicated on the plans and will furnish EP switches, electrical thermostats, pressure switches and other temperature control devices as required by the specific sequence of operation for installation by the Electrical Contractor. Others will do testing and adjusting of mechanical system devices.
- B. The motor and appliance control devices shall be as follows:
 1. All starters shall be installed in NEMA 1 Enclosure unless noted otherwise on the drawings. Where noted other than NEMA 1, furnish the indicated NEMA rated enclosure.
 2. Single Phase Magnetic Starters - Square D Class 8536 with one overload, 120 volt coil, N.O. auxiliary contacts, heavy-duty 30 mm and hand-off-automatic selector switch in cover all in an oversized NEMA enclosure.
 3. Three Phase Manual Starters - Square D Class 2510 Type M, push button operated, lock-out guard, three thermal overloads in a NEMA enclosure. Furnish with or without pilot light and auxiliary contacts as indicated on drawings.
 4. Three Phase Magnetic Starters - Square D Class 8536 with three overloads, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy-duty 30 mm, hand-off-automatic selector switch, heavy-duty 30 mm pilot light, and extra N.O. auxiliary contacts all in a NEMA enclosure.

5. Three Phase Combination Starter and Fusible Disconnect Switch - Square D Class 8538 with a NEMA enclosure including a three pole fusible switch and a starter with three overloads, 120 volt control transformer with 2 primary and 1 secondary fuses, heavy-duty 30 mm, hand- off-automatic selector switch and heavy-duty 30 mm pilot light and N.O. auxiliary contacts.
6. Fractional HP Single Phase Manual Starters - Square D Class 2510 Type F, toggle switch operated with lock-out guard, single thermal overload. Furnish starters single speed with or without pilot lights as indicated on the drawings. All surface mounted starters shall be mounted in a 'FS' conduit box.
7. Integral HP Single Phase Manual Starters – Square D Class 2510 Type M, push button operated, lock-out guard, single thermal overload in NEMA enclosure. Furnish with or without pilot light and auxiliary contacts as indicated on drawings.
8. Selector Switches and Pushbutton Stations - Square D Class 9001 heavy duty 30 mm in NEMA enclosure.
9. Provide a 3" wide x 1½" high phenolic nameplate reading the following for each motor starter:

EQUIPMENT IDENTIFICATION	(3/8" Lettering)
Size ' _ ', ___A Overload	(1/4" Lettering)
FED FROM _____	(1/4" Lettering)
10. Relays - Square D Class 8501 with 120-volt coil in NEMA 1 enclosure. Furnish with number of poles indicated on the plans.
11. Provide a phenolic nameplate for each motor starter.
12. Devices of similar construction and design as manufactured by Eaton Cutler Hammer, Allen Bradley, Siemens, or General Electric by ABB are also acceptable.

26 29 23 VARIABLE FREQUENCY DRIVES

- A. The Electrical Contractor shall provide variable frequency drives as shown on the drawings. The Electrical Contractor shall furnish and install the controller, control devices, and interconnection wiring as specified below.
- B. Drive General Description:
 1. Furnish and install variable frequency drives as specified herein. The assembly shall include a circuit breaker or input fuses, motor overload relay(s) and operational options required by this specification.
 2. A factory authorized trained technician shall make final adjustments and settings on the drives and shall submit a field report to the Engineer stating the setpoints and ramp time settings on each drive.
- C. Drive Components:
 1. The variable frequency drive system shall include a diode bridge rectifier, DC link reactor for reduction of harmonics, capacitor filter, and IGBT inverter section. The output shall be capable of a 12khz sine-coded pulse width modulated output for quiet operation. The drive ratings shall be based upon 4khz output.

2. Refer to Mechanical Electrical Interface for maximum carrier frequency rating.

3. The controller shall include the following devices:

- a. Drive manual on-off-auto selector switch to manually energize or de-energize the drive control system.
- b. Manual speed selector to allow a specified speed to be selected and maintained if the manual-off-automatic selector switch is in the manual position.
- c. 4-20 milliamp output that is directly proportional to drive speed.

4. Provide a 3" wide x 1" high phenolic nameplate for each starter or disconnect as follows:

EQUIPMENT IDENTIFICATION (3/8" Lettering)
__AS/ __AF (XX AMP SWITCH/XX AMP FUSE) (1/4" Lettering)

OR
EQUIPMENT IDENTIFICATION (3/8" Lettering)
Size ' _ ', __A Overload (1/4" Lettering)

5. The system protection as a minimum will provide the following:

- a. Overcurrent protection of 100% continuous, 110% for 1 minute.
- b. Instantaneous overcurrent trip at 150%.
- c. Current limit stall prevention shall be adjustable 10 to 110%.
- d. Ground fault protection.
- e. Current limiting DC bus fuse.
- f. Overvoltage protection.
- g. Undervoltage protection.

6. When the drive faults, the drive shall activate a 1NO, 1NC-fault relay display for indication of type of trip.

- a. OC: Overcurrent trip at 150%
- b. OCA: Overcurrent on start-up
- c. OCL: Overcurrent on output
- d. OL: Overload
- e. OP: Overvoltage due to power surge

- f. OP2: Overvoltage while deceleration
- g. POFF: Undervoltage
- h. OH: Overheat
- i. EF: Ground faults

7. Auto restart shall be a standard feature of the drive as follows:

- a. Auto restart enabled or disabled by jumper or keypad selection.

If auto restart is selected the microprocessor shall determine, in the event of a fault, if a restart should be attempted. A restart will be attempted under the following condition:

Undervoltage (UP) - Every time as soon as voltage returns to a safe level. Fault relay is not activated.

Input Overvoltage (OPS) and DC Bus Overvoltage (OP) - Every time if voltage returns to normal within 30 seconds, fault relay is not activated.

Overcurrent (OC) - Drive delays 1 second and attempts a restart. If drive trips a second time it delays 2 seconds and attempts a second restart. Overall, five attempts are made after successive delays of 1, 2, 4, 8 and 16 seconds. If the restart fails, the drive locks out and sets the fault relay on. (Number of restarts and time delays to be adjustable via keypad or jumpers).

A restart will not be attempted for any other type of fault and the drive will trip out immediately, activate the fault relay and make the appropriate indication on the display.

8. In the event of a fault trip the microprocessor shall save the status of the drive at the time of the fault and make that information available on the display until the drive is reset or the control power is removed.

9. An undervoltage condition of less than 100 ms duration shall not affect drive operation. If main power falls below 85% of rated voltage for longer than 100 ms while control power is retained the drive shall forcibly decelerate the load in an attempt to force a higher bus voltage through regeneration. This feature, depending on the inertia of the load, shall allow the drive to "ride through" a longer condition.

10. A minimum of 3% DC link or line reactor.

11. Operation functions shall include the following:

Acceleration and deceleration time independently adjustable from .1 to 1200 seconds.

Signal follower 0-5VDC, 0-10VDC, 4-20ma, 0-20ma, 1- 5VDC, or 0-135 ohms selectable. An increasing input signal can command increasing or decreasing frequency as required by the application.

Ramp to stop or coast to stop for normal operation (coast to stop on fault). Volts/Hertz patterns selectable by keypad.

Upper and lower frequency limit adjustments shall be available. When the drive reaches one of the limits it shall activate an open collector signal available to the user. A dry contact signal shall be available as an option.

12. Drives shall have a Short Circuit Current Rating (SCCR) of 100,000 amps.
- D. The following catalog data shall be submitted for the controller:
 1. Dimensioned drawings.
 2. Operation and installation manuals.
 3. Maintenance, adjustment, part breakdown and troubleshooting manual.
 4. Connection diagrams.
 5. Schematic diagrams including printed circuit boards, wiring harnesses, and enclosure mounted controls.
- E. **[E. Drives shall be furnished with a [BACNET] [N2] [MODBUS] [SIEMENS] Network Card factory installed.]**
- F. Refer to Section 26 00 72 for support of equipment and "housekeeping pad requirements".
- G. Variable frequency drives shall be Toshiba Q9 Plus, YASKAWA HV600, or ABB ACH 580.

26 50 00 LIGHTING

26 51 00 LIGHT FIXTURES AND LAMPS

26 51 19 LED INTERIOR LIGHTING

A. RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SUMMARY

1. Section Includes all LED Interior luminaries.
2. Related Requirements:
 - a. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
 - b. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - c. Drawings for Luminaire Schedule.

C. DEFINITIONS

1. CCT: Correlated color temperature.
2. CRI: Color Rendering Index.
3. Fixture: See "Luminaire."
4. IP: International Protection or Ingress Protection Rating.
5. LED: Light-emitting diode.
6. Lumen: Measured output of lamp and luminaire, or both.
7. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

D. ACTION SUBMITTALS

1. Product Data: For each type of product.
 - a. Arrange in order of luminaire designation.
 - b. Include data on features, accessories, and finishes.
 - c. Include physical description and dimensions of luminaires.
 - d. Include emergency lighting units, including batteries and chargers.
 - e. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - f. Include sample warranty.
2. Shop Drawings: For nonstandard or custom luminaires.
 - a. Submit factory drawings with the following additional information included:
 - i. Plans, elevations, sections, and mounting and attachment details.
 - ii. Details of luminaire assemblies. Indicate dimensions of fixture including individual lens lengths, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - iii. Diagrams for power, signal, control wiring, and emergency lighting locations.
 - iv. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - v. Product Certificates: for each type of Luminaire.

- vi. Product Test Reports: For each luminaire, for test performed by a qualified testing agency.
- vii. Sample warranty.

E. PRODUCT SUBSTITUTIONS

1. Product Substitutions shall be submitted 10 days in advance of bid-day. All products included in bid shall be of equal or better quality to the basis of design.

F. CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - a. Provide a list of all Lamps/LED Light Bars & Drivers/Transformers used on Project; use ANSI and manufacturers' codes.

G. MAINTENANCE MATERIAL SUBMITTALS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Lamps/LED Light Bars: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - b. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - c. Drivers/Transformers: One for every 100 of each type and rating installed. Furnish at least one of each type.

H. QUALITY ASSURANCE

1. Luminaire Photometric Data Testing Laboratory Qualifications:
 - a. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
 - b. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
2. Provide luminaires from a single manufacturer for each luminaire type.
3. Each luminaire type shall be binned within a three-step MacAdam Ellipse or better to ensure color consistency among luminaires.

I. DELIVERY, STORAGE, AND HANDLING

1. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

J. WARRANTY

1. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
2. Warranty Period: From date of Substantial Completion.
 - a. Manufacturer: Five years minimum, unless otherwise noted.
 - b. Installer: One year minimum, unless otherwise noted.

K. PERFORMANCE REQUIREMENTS

1. Seismic Performance:
 - a. Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - b. Luminaires and lamps shall be labeled vibration and shock resistant.
 - c. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Ambient Temperature: 41 to 104 deg F.
 - a. Relative Humidity: Zero to 95 percent.

L. LUMINAIRE REQUIREMENTS

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place. Labels shall include but not limited to CCT, CRI and Lumens.
 1. CRI of minimum 80. CCT of 3500K (interior). 4000K (exterior)
 2. Related minimum luminaire life of 100,000 hrs to L70.
 3. Luminaire dimmable from 100 percent to 10 percent of maximum light output unless otherwise specified on Luminaire Schedule.
 4. All recessed fixtures less than 3" in diameter have accessibility to driver without reaching into ceiling cavity.

5. Lens:
 - a. Acrylic diffusers: 100% virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - b. At least 0.125 inch minimum unless otherwise indicated on Luminaire schedule.
6. Housings: See luminaire schedule for exact requirements.
7. Recessed luminaires shall comply with NEMA LE 4.

M. MATERIALS

1. Metal Parts:
 - a. Free of burrs and sharp corners and edges.
 - b. Sheet metal components shall be steel unless otherwise indicated.
 - c. Form and support to prevent warping and sagging.
2. Steel:
 - a. ASTM A36/A36M for carbon structural steel.
 - b. ASTM A568/A568M for sheet steel.
3. Stainless Steel:
 - a. Manufacturer's standard grade.
 - b. Manufacturer's standard type, ASTM A240/240M.
4. Galvanized Steel: ASTM A653/A653M.
5. Aluminum: ASTM B209.
6. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions.
7. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position

N. METAL FINISHES

1. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

O. EXAMINATION

1. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. EC shall receive approval from engineer/lighting designer prior to luminaire installation when there is a layout change due to unforeseen conditions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

P. TEMPORARY LIGHTING

1. If approved by the Architect, Engineer and Lighting Designer, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting.

Q. INSTALLATION

1. Comply with NECA 1.
2. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
3. Install per manufacturer's installation instructions.
4. Supports:
 - a. Sized and rated for luminaire weight.
 - b. Able to maintain luminaire position after cleaning and relamping.
 - c. Provide support for luminaire without causing deflection of ceiling or wall.
 - d. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
5. Flush-Mounted Luminaires:
 - a. Secured to outlet box.
 - b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - c. Trim ring flush with finished surface.
6. Wall-Mounted Luminaires:
 - a. Attached to structural members in walls
 - b. Do not attach luminaires directly to gypsum board.
7. Suspended Luminaires:
 - a. Ceiling Mount:

- i. Aircraft cable size and support locations per manufacturer's requirements. See drawings for exact length.
 - ii. Aircraft cable supports and quantity per manufacturer's requirements. See drawings for exact length.
 - iii. Hook mount.
 - b. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - c. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - d. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod, or wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - e. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure. See seismic detail on drawings.
8. Ceiling-Grid-Mounted Luminaires:
- a. Secure to any required outlet box.
 - b. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - c. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
9. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

R. FIELD QUALITY CONTROL

- 1. Perform the following tests and inspections:
 - a. After installing luminaires, lighting controls, and accessories, and after electrical circuitry has been energized, test luminaires with controls to confirm proper operation. Any defective component in the lighting systems shall be replaced and the system reprogrammed if necessary.
 - b. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- 2. Luminaire will be considered defective if it does not pass operation tests and inspections.

S. ADJUSTING

1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - a. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - b. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

26 52 13 EMERGENCY BATTERY BACKUP BALLAST

A. Emergency Lighting Transfer Device

1. Lighting Transfer/Bypass Device (LTB) with Remote Test Button
 - a. UL 924 listed.
 - b. Contact ratings:
 - I. 20 amp magnetic ballast @ 277 Vac
 - II. 16 amp electronic ballast @ 277 Vac
 - c. Bypasses local manual or automatic lighting controls so an emergency luminaire provides full brightness during a power outage. Normally downstream of a UL 1008 listed Automatic Transfer Switch (ATS) or Lighting Transfer Switch (LTS).
 - d. Includes a dry contact to interrupt 0-10V dimming control circuit.
 - e. Includes remote test input to be used with Functional Devices Remote Test Button #ESRTB (or equivalent). Provide and install the Remote Test Button in an accessible location flush in the ceiling or above 80" AFF on wall or where indicated on the drawings.
 - f. Functional Devices Automatic Load Control Relay #ESRN or equivalent.
2. Lighting Transfer Switch (LTS)
 - a. UL 1008 listed.
 - b. Contact ratings:
 - I. 20 amp lighting load @120-277 Vac
 - c. Switches between a normal and emergency source/circuit.
 - d. Includes a dry contact to interrupt 0-10V dimming control circuit.

- e. Myers Branch Circuit Emergency Lighting Transfer Switch #EPC-D-F-LS or equivalent.

END OF SECTION

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27 00 00 COMMUNICATIONS

27 00 01 GENERAL

- A. The Plans, the general provisions of the Contract including the General, Supplementary and/or Special Conditions and specification sections of Division 1 shall apply to Work of Division 27 of the Specifications.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Division 27 of these Specifications.

27 00 02 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc., as identified in Division 27.

27 00 03 REFERENCES, RELATED SECTIONS of the SPECIFICATIONS

- A. Requirements of the following Sections of the Specifications apply to Work for this Section:
 - Division 26 – Electrical
 - Division 28 – Electronic Safety and Security

27 00 04 DEFINITIONS

- A. Refer to Section 26 00 05 – Definitions.

27 00 05 WORK INCLUDED

- A. Furnish material, labor and services necessary for, and incidental to, installing the following systems where shown on the Plans and as hereinafter specified. Include all necessary work in the related sections of the Specifications to provide for complete systems.
- B. Refer to the Low Voltage Responsibility Matrix shown on the drawings for more information.

27 00 06 SUBMITTALS:

- A. The Contractor shall submit the following for approval in accordance with Subsection 20 00 43, Duties of the Contractor - Submittals.
- B. Provide manufacturer's technical product data of each material and accessory item with engineering support information, installation manual, operation and maintenance manual. Data shall be specific to product specified and clearly identified on all data sheets, which contains multiple models or sizes.

27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. All cabling shall be as shown on plans, and per specifications.

- C. Cabling may be run as open-type plenum rated cable concealed above lay-in ceiling spaces and shall be run in new j-hooks spaced no more than 5 feet apart.
- D. Non plenum rated cabling shall be installed in conduit. Cabling shall be installed in conduit in all exterior locations and in all exposed or inaccessible locations including all open to structure, cloud ceilings, inside wall partitions or above drywall, wood, and other inaccessible ceilings.
- C. Cables shall be continuous from outlet to termination equipment.
- D. Specified Technologies, Inc. EZ Path 4x4.in all walls which cable runs pass through.
- E. Furnish and install a minimum of (1) one cable pathway device through fire rated partitions and floors, and where indicated on the drawings. Device shall be Specified Technologies, Inc. EZ Path 4x4.
- F. Refer to 26 05 29 for fire sealing of penetrations through fire rated walls.
- G. Provide access panels as necessary for cable routing.

27 05 28.29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

- A. Cables shall be supported with “J-Hooks” a minimum of every five feet. Bridal rings can be used when supporting (other than Cat 6) a maximum of six wires. Support devices are to be attached to existing permanent structure.
- B. Cables shall be installed in cable tray where available.
- C. Cables and supports shall be installed at a readily accessible location above ceilings.

27 05 28.33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

- A. Furnish and install conduit rough-ins at all outlets locations where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a minimum 1” conduit stubbed above an accessible ceiling. Plastic bushings shall be installed on both ends of conduit. Install blank covers on all unused rough-ins.
- C. All conduits serving telephone/data communication outlets shall be 1” minimum. Conduits for all other system cable runs shall be sized for 40% maximum fill, or as shown on the drawings. Redundant paths shall be installed where fill exceeds 40%.
- D. Provide pull strings in all conduits.
- E. Conduit bends shall accommodate radius requirements of fiber cable as necessary.

27 15 00 COMMUNICATIONS HORIZONTAL CABLING

27 15 13 COMMUNICATIONS COPPER HORIZONTAL CABLING

- A. Description of Work
 - 1. Refer to the Low Voltage Responsibility Matrix on the drawings for more information.

2. The Contractor shall be trained and certified by the equipment manufacturer.
3. The Contractor shall attend coordination meetings with the Owner and Engineer prior to installation.

B. Acceptable Manufacturers

1. Subject to compliance with requirements, provide telephone/data cabling system components from the following manufacturers:

Homaco
Panduit
Hoffman

C. Rough-Ins

1. Furnish and install rough-ins where shown on drawings. Rough-in shall consist of a two-gang outlet box, single gang trim ring, and a minimum 1" conduit stubbed above an accessible ceiling. Install blank covers on all unused rough-ins.
2. Maximum fill of conduit is not to exceed forty percent.
3. Furnish and install minimum 2" sleeve through fire rated partitions.
4. Refer to 260529 for fire sealing of penetrations through fire rated walls.

END OF SECTION
27 00 00

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