

BINGHAM HALL - UPDATE COURTYARD AREA

FOR THE CURATORS OF THE UNIVERSITY OF MISSOURI

ISSUED FOR BID

PROJECT MANUAL

PROJECT NO. CP231011

DECEMBER 22, 2025



INTERNATIONAL ARCHITECTS ATELIER



PROJECT MANUAL FOR: BINGHAM HALL – UPDATE COURTYARD AREA

PROJECT NUMBER: CP231011

AT
UNIVERSITY OF MISSOURI–COLUMBIA
COLUMBIA, MISSOURI

FOR:

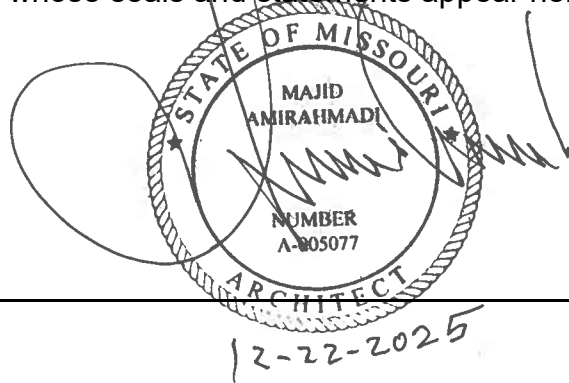
THE CURATORS OF THE UNIVERSITY OF MISSOURI

PREPARED BY:
International Architects Atelier
Majid Amirahmadi, AIA
912 Broadway, Suite 300
Kansas City, MO 64105
P: 816-481-6522

DATE: December 22, 2025

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.



Signature: _____

CIVIL

The Engineer's seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the Engineer takes responsibility for the attached civil 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.

12/22/2025



Signature: _____

IRRIGATION

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

Signature:



ELECTRICAL AND PLUMBING

The Engineer's seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the Engineer takes responsibility for the attached electrical and plumbing 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.

Signature: _____

Russell Vinson



12-22-25

STRUCTURAL

The Engineer's seal on these contract documents has been affixed in accordance with the requirements of Chapter 327, RSMO. In affixing this seal, the Engineer takes responsibility for the attached structural 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.

Signature: _____



PROJECT MANUAL FOR: BINGHAM HALL – UPDATE COURTYARD AREA

PROJECT NUMBER: CP231011

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END OF SECTION

PLANNING DESIGN & CONSTRUCTION

900 E. Stadium, Ste. 130
Columbia, Missouri 65211
Telephone: (573) 882-6800

ADVERTISEMENT FOR BIDS

Sealed bids for:

Bingham Hall –
Update Courtyard Area
UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI

PROJECT NUMBER: CP231011

CONSTRUCTION ESTIMATE: \$2,689,476 - \$2,988,307

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.S.T., January 27, 2026 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 should be directed to Majid Amirahmadi with International Architects Atelier, Inc. at (816) 471-6522 or majid@i-a-a.com. Questions regarding commercial conditions should be directed to Emily Johnson at (573) 882-1108 or johnsonemilym@missouri.edu.

A prebid meeting will be held at 10:00 a.m., C.S.T., January 15, 2026 in the General Services Bldg., Room 194A, followed by a site walk-through.

This project has participations goals for Minority Business Enterprises (MBE), Women Business Enterprises (WBE) and Service-Disabled Veteran Business Enterprises (SDVE) as follows: 10% MBE, 10% WBE, 3% SDVE. Please see the Information for Bidders and General Conditions for additional information about the MBE/WBE/SDVE Participation Goals.

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) 882-6800.

Advertisement Date: December 23, 2025

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 INTERNATIONAL ARCHITECTS ATELIER, entitled "BINGHAM HALL – UPDATE COURTYARD AREA", project number CP231011, dated DECEMBER 22, 2025 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 the following Bid(s), amount (s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. **BID PRICING**

a. **Base Bid:**

The Bidder agrees to furnish all labor, materials, tools, and equipment required to renovate the exterior courtyard outside Bingham Hall; 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 effect on Bids of Contractor and each Subcontractor and/or Material supplier.

- (1) Additive Alternate No. 1: Provide Area 'B' with concrete paving, modular weathering steel planting walls with integrated benches and swing bench seating. Provide power and lighting associated with the area indicated, RE: Elect. All for sum of:

_____ DOLLARS (\$_____).

- (2) Additive Alternate No. 2: Provide sandblasted concrete texture in pattern indicated. All for sum of:

_____ DOLLARS (\$_____).

- (3) Additive Alternate No. 3: Provide Area 'C' with concrete paving and concrete walls with integrated benches. Provide power and lighting associates with the area indicated, RE: Elect. All for sum of:

_____ DOLLARS (\$_____).

- (4) Additive Alternate No. 4: Provide catenary lighting scheme in lieu of base bid lighting scheme, RE: Elect. All for sum of:

_____ DOLLARS (\$_____).

- (5) Additive Alternate No. 5: Provide Area 'A' with concrete paving and swing bench seating. All for sum of:

_____ DOLLARS (\$_____).

4. PROJECT COMPLETION

a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within Three hundred and nineteen (319) calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.

b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.

c. Special scheduling requirements: none.

5. SUBCONTRACTOR LIST:

Bidder hereby certifies that the following subcontractors will be used in performance of Work:

NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List name, city, and state of designated subcontractor, for each category of work listed in Bid For Lump Sum Contract. If work within a category will be performed by more than one

subcontractor, Bidder shall provide name, city, and state of each subcontractor and specify exact portion of work to be performed by each. If acceptance/non-acceptance of Alternates will affect designation of a subcontractor, Bidder shall provide information, for each affected category, with this bid form. If Bidder intends to perform any designated subcontract work by using Bidder's own employees, then Bidder shall list their own name, city, and state. The bidder may petition the Owner to change a listed subcontractor only within 48 hours of the bid opening. See Information For Bidders Section 16 List of Subcontractors for requirements.

Work to be performed	Subcontractor Name,	City, State
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Concrete

Electrical

6. MBE/WBE/SDVE PARTICIPATION

- a. SDVE Bonus Preference: A three (3) point bonus preference will be given to a Bidder that is a certified Service-Disabled Veteran Business Enterprise (SDVE) doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, as stated in the Information for Bidders. By indicating "Yes" below, the Bidder certifies that the Bidder is certified as an SDVE by the State of Missouri, Office of Administration.

Yes _____ No _____

- a. MBE/WBE/SDVE Participation Goals: The Bidder shall have a goal of providing participation in the contract of Minority Business Enterprises (MBE) of ten percent (10%) with Women Business Enterprises (WBE) of ten percent (10%), and with Service-Disabled Veteran Business Enterprises (SDVE) of three percent (3%) of the awarded contract price for work to be performed.
- b. Good Faith Effort Waiver: Requests for waiver of these goals due to good faith effort shall be submitted on the attached Application For Waiver form. A determination by the UM Executive Director of Facilities Planning and Development that a good faith effort has not been made by Bidder to achieve above stated goals may result in rejection of the bid.
- c. The undersigned Bidder proposes to perform work with the MBE/WBE/SDVE participation level set forth below. An MBE/WBE/SDVE Compliance Evaluation form shall be submitted with this bid for each MBE/WBE/SDVE subcontractor to be used on this project.

MBE PERCENTAGE PARTICIPATION: _____ percent (____%)
WBE PERCENTAGE PARTICIPATION: _____ percent (____%)
SDVE PERCENTAGE PARTICIPATION: _____ percent (____%)

7. BIDDER'S ACKNOWLEDGMENTS

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

b. Bidder agrees that bid shall not be withdrawn for a period of 90 days after scheduled closing time for receipt of bids.

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

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

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

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

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

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

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

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

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

e. He will not discriminate against any employee or applicant for employment because of

race, color, religion, sex or national origin in connection with performance of work.

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

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

**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. Are you or your company certified by the State of Missouri, Office of Administration as a Minority Business Enterprise (MBE), Women Business Enterprise (WBE), or Service-Disabled Veteran Business Enterprise (SDVE)?
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

MBE/WBE/SDVE COMPLIANCE EVALUATION FORM

This form shall be completed by Bidders and submitted with the Bidder's Statement of Qualifications form for each MBE/WBE/SDVE firm that will perform work under the contract. The undersigned submits the following data with respect to this firm's assurance to meet the goal for MBE/WBE/SDVE Participation.

1. Project: _____
2. Name of General Contractor: _____
3. Name of MBE/WBE/SDVE Firm: _____
Address: _____
Phone No.: _____ Fax No.: _____
Status (check one) MBE _____ WBE _____ Service-Disabled Veteran _____
4. Describe the work to be performed. (List Base Bid work and any Alternate work separately):
Base Bid:

5. Dollar amount of contract to be subcontracted to the MBE/WBE/SDVE firm:
Base Bid:
Alternate(s), (Identify separately):

6. Is the proposed firm certified as an MBE/WBE/SDVE by the State of Missouri, Office of Administration?
Yes _____ No _____

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 meet the MBE/WBE/SDVE Participation Goals for that project. 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 Bidder's efforts to meet the MBE/WBE/SDVE Participation Goals.

1. List pre-bid conferences your firm attended where MBE/WBE/SDVE Participation Goals were discussed.

2. Identify advertising efforts undertaken by your firm which were intended to recruit potential MBE/WBE/SDVE subcontractors or suppliers 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 MBE/WBE/SDVE firms capable of and likely to participate as subcontractors or suppliers for this project.

4. Describe steps taken by your firm to divide work into areas in which MBE/WBE/SDVE firms would be capable of performing.

5. What efforts were taken to negotiate with prospective MBE/WBE/SDVE? Include the names, addresses, and telephone numbers of MBE/WBE/SDVE firms contacted, a description of the information given to MBE/WBE/SDVE firms regarding plans and specifications for the assigned work, and a statement as to why additional agreements were not made with MBE/WBE/SDVE firms.

6. List reasons for rejecting an MBE/WBE/SDVE firm which has been contacted.

7. Describe the follow-up contacts with MBE/WBE/SDVE firms made by your firm after the initial solicitation.

8. Describe the efforts made by your firm to provide interested MBE/WBE/SDVE firms with sufficiently detailed information about the plans, specifications and requirements of the contract.

9. Describe your firm's efforts to locate MBE/WBE/SDVE firms.

Based on the above stated good faith efforts made to meet the MBE/WBE/SDVE Participation Goals, the Bidder hereby requests that the original 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 UM Executive 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 _____, 20__, before me appeared _____ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by _____ to execute the affidavit and did so as his or her own free act and deed.

(Seal)

Notary Public

Commission expires: _____

University of Missouri

INFORMATION FOR BIDDERS

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June 2025 Edition

1. Contract Documents and Definitions

1.1 The “Drawings,” “Specifications,” and “Contract Documents” are defined in the “General Conditions of the Contract for Construction.”

1.2 The Drawings, Specifications, and other Contract Documents may be obtained as indicated in the Advertisement for Bids.

1.3 As used herein, “Bid” refers to an offer or proposal submitted to the Owner to enter into a contract for the work identified in the Drawings, Specifications and other Contract Documents.

1.4 As used herein, “Bidder” means an individual or business entity that submits a Bid to the Owner as a prime bidder or general contractor.

1.5 All other terms used herein shall have the meanings defined herein or in the General Conditions of the Contract for Construction or other Contract Documents.

2. Bidder Obligations

2.1 Before submitting a Bid, each Bidder shall carefully examine the Drawings and Specifications and related Contract Documents, visit the site of the work, and fully inform themselves as to all existing conditions, facilities, restrictions, and other matters that could 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 specified in the Drawings, Specifications, and other Contract Documents. All work shall be done as defined in the Specifications and as indicated on the Drawings.

2.3 Failure or omission of any Bidder to receive or to examine any form, instrument, addendum, or other document, or to visit the site of the work and acquaint themselves with existing conditions, shall in no way relieve the Bidder from any obligation with respect to their Bid or any awarded contract. No extra compensation will be allowed concerning any matter about which the Bidder should have fully informed themselves prior to submitting a Bid.

2.4 Submission of a Bid shall be deemed acceptance by the Bidder of the above obligations and every obligation required by the Contract Documents in the event the Bid is accepted by the Owner.

3. Interpretation of Documents

3.1 If any prospective Bidder is in doubt about the meaning of any part of the Drawings, Specifications, or other Contract Documents, the Bidder shall submit a written request to the Architect for an interpretation.

3.2 Any request for interpretation shall be delivered to the Architect at least one (1) week prior to time for receipt of bids.

3.3 A Bid shall be based only on an interpretation issued in the form of an addendum mailed to each person or business

entity that is on the Architect’s record as having received a set of the Contract Documents.

3.4 Bidders shall not be entitled to rely on oral interpretations or written statements not issued in an addendum from either the Architect or a representative, agent, or employee of the Owner.

4. Bids

4.1 Bids shall be submitted on a single “Bid for Lump Sum Contract” form (“Bid Form”) as furnished by the Owner or Architect. Bids shall be received separately or in combination as required by Bid Form

4.2 In addition to the Bid Form, the Bid shall include any documents or information required to be submitted by this Information for Bidders or the Contract Documents.

4.3 Bids shall include amounts for alternate bids, unit prices, and cost accounting data where required by the Bid Form.

4.4 Bidders shall apportion each base Bid between various phases of the work, where stipulated in the Bid Form.

4.5 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.

4.6 Each Bidder shall be responsible for actual delivery of their bid 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.

4.7 The Bidder’s price shall include all federal sales, excise, and similar taxes that may be lawfully assessed in connection with their performance of work and purchase of materials to be incorporated in the work. City and State taxes shall not be included as stated in the General Conditions of the Contract for Construction.

4.8 No Bidder shall stipulate in their Bid any conditions not contained in the Bid Form or Contract Documents. Inclusion of any additional conditions or taking exception to any terms may result in rejection of the Bid.

4.9 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 A Bidder may withdraw their Bid at any time before the scheduled closing time for receipt of bids. No Bidder may withdraw their Bid after the scheduled closing time for receipt of bids.

5.2 Only a written request for modification or correction of a previously submitted Bid, contained in a sealed envelope that is plainly marked “Modification of Bid on (name of project on cover sheet),” which is addressed in the same manner as a Bid and

received by Owner before the scheduled closing time for receipt of bids, will be accepted and the Bid modified in accordance with such written request.

6. Signing of Bids

6.1 All bids shall be signed manually, by an individual authorized to sign on behalf of the Bidder. The title or office held by the person signing for the Bidder shall appear below the signature.

6.2 A Bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the Bid form should appear as shown in the Secretary of State's records.

6.3 A Bid from a partnership or joint venture shall be signed in the name of the partnership or joint venture by at least one partner or joint venturer or by an 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 executed by all partners or joint venturers.

6.4 A Bid from a corporation shall be signed by an officer of the corporation.

6.5 A Bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.

6.6 A Bid from an individual or sole proprietor shall be signed in the name of the individual by the individual or an 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 executed by the individual.

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 the Bidder's Bid including additive alternates ("Bid Security").

7.2 Bid security is required as a guarantee that the Bidder will enter into a written contract and furnish a Performance Bond within the time and in form as specified herein or in the Contract Documents; 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 forty-eight (48) hours of the Bid opening of any circumstance that may affect the Bid Security including, but not limited to, an error in the Bid. 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 Bid 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 the contract and Performance Bond, nor limit or fix the Bidder's liability to the Owner for any damages sustained because of failure to execute and deliver the required contract and Performance Bond.

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

8. Bidder's Statement of Qualifications

8.1 Each Bidder 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 "Bidder's Statement of Qualifications" form included with the Bid documents.

8.2 Financial information required to be included with the Statement of Qualifications may be submitted by the Bidder in a separately sealed envelope, which will not be opened by the Owner during the public Bid opening.

8.3 The Bidder's Statement of Qualifications will be treated as confidential information by the Owner to the extent permitted by the Missouri Sunshine Law, Section 610.010, RSMo et seq.

8.4 Bids not accompanied by the 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 limited to, 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 ability of the Bidder, and their subcontractors, to handle promptly the additional work; the skill, facilities, capacity, experience, ability, responsibility, previous work, and financial standing of Bidder; the Bidder's ability to provide the required bonds and insurance; the quality, efficiency and construction of equipment proposed to be furnished; the period of time within which equipment is proposed to be furnished and delivered; success in achieving the specified MBE/WBE/SDVE Participation Goals or demonstrating a good faith effort to do so as described in Article 15 of this document; 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 awarded Bidder shall submit within fifteen (15) days from receipt of notice of award, the documents required in Article 9 of the General Conditions of the Contract for

Construction.

10.2 No bids will be considered binding upon the Owner until all such required documents have been furnished. Failure of Contractor to execute and submit such documents within the time specified will be treated, at the option of the Owner, as a breach of the Bidder's Bid Security and the Owner shall be under no further obligation to the 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 the 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 the Contractor's faithful performance of the Contract, including but not limited to the Contractor's obligation to correct any 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 the Contract and furnishing materials in connection with the Contract in accordance with Section 107.170, RSMo. These bonds shall be in effect through the duration of the Contract plus any Guaranty Period required by the Contract Documents.

11.2 The bonds required hereunder shall meet all requirements of Article 11 of the General Conditions of the Contract for Construction.

11.3 If the surety of any bond furnished by the 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, the Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to the Owner. If the Contractor fails to make such substitution, the Owner may procure such required bonds on behalf of Contractor at Contractor's expense.

12. Time of Completion

12.1 The awarded Contractor 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 of the Contract for Construction.

13. Number of Contract Documents

13.1 The Owner will furnish the Contractor a copy of the executed contract, Performance Bond, and Payment 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.

14.2 MBE/WBE/SDVE Participation Award of Contract

14.2.1 Pursuant to Sections 37.020 and 34.074, RSM (and the implementing regulations adopted by the State of Missouri, Office of Administration), the University of Missouri System sets goals for the participation of Minority Business Enterprise, Women Business Enterprise and Service Disabled Veteran Business Enterprise (MBE/WBE/SDVE) Firms (as defined in Article 1 of the General Conditions of the Contract for Construction) in its construction projects. The applicable goals for each project shall be as stated in the Bid Form. The standard goals for University projects by location are identified in the document entitled MBE/WBE/SDVE Participation Goals; however, the Executive Director of Facilities Planning and Development may set higher or lower MBE or WBE goals for a specific project by reviewing the type of project, elements of work to be performed, time for contract performance, and geographical location, history of MBE/WBE and non-MBE/WBE utilization, and availability of ready, willing, and able certified MBE/WBEs.

14.2.2 The Bidder shall have a minimum goal of providing participation of Minority Business Enterprise, Women Business Enterprise and/or Service Disabled Veteran Business Enterprise (MBE/WBE/SDVE) Firms in the project, through self-performance, if a MBE/WBE/SDVE Firm, or by subcontracting with MBE/WBE/SDVE Firms as subcontractors, suppliers, or manufacturers, in the amount of the percent of contract price stated in the Bid Form ("MBE/WBE/SDVE Participation Goals"). The Owner will take into consideration the Bidder's success in achieving the MBE/WBE/SDVE Participation Goals in awarding the contract. Inability of any Bidder to meet one or more of the MBE/WBE/SDVE Participation Goals shall be cause for rejection of their Bid, unless the Bidder has demonstrated that they made a good faith effort to comply as set forth below.

14.2.3 In addition to the MBE/WBE/SDVE Participation Goals set forth in the Bid Form, a three (3) point bonus preference will be given to a Bidder that is a certified Service-Disabled Veteran Enterprises (SDVE) business doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business. The bonus preference will **not** be given to a Bidder for the use of SDVE subcontractors, suppliers, or manufacturers. The bonus preference shall be calculated and applied by reducing the Bid amount of the SDVE Bidder by three

(3) percent of the apparent low, responsive Bidder's Bid. Based on this calculation, if the SDVE Bidder's resulting total Bid valuation is less than the Bid of the apparent low, responsive Bidder, the SDVE 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 SDVE Bidder's Bid or the amount(s) of any contract awarded.

14.3 List of MBE/WBE/SDVE Firms

14.3.1 The Bidder shall submit, within forty-eight (48) hours of the receipt of bids to the University Contracting Officer, a list of MBE/WBE/SDVE Firms that will be performing as contractor, subcontractor, supplier, or manufacturer on the project. The list shall separately identify each MBE/WBE/SDVE Firm by name and address. If acceptance or non-acceptance of alternates will affect the designation of a subcontractor, supplier, or manufacturer, the Bidder shall provide information for each affected category.

14.3.2 Failure to include a complete list of MBE/WBE/SDVE Firms that will be used to meet the MBE/WBE/SDVE Participation Goals may be grounds for rejection of the Bid.

14.3.3 The list of MBE/WBE/SDVE Firms shall be submitted in addition to any other listing of subcontractors required in the Bid Form or elsewhere in this document.

14.4 MBE/WBE/SDVE Participation Computation

14.4.1 The Bidder may count toward the Supplier Diversity Goal only expenditures to MBE/WBE/SDVE Firms that perform a commercially useful function in the work of a contract. An MBE/WBE/SDVE Firm is considered to perform a commercially useful function when it is responsible for executing a distinct element of the work or contract and is carrying out its responsibilities by actually performing managing and supervising the work.

14.4.2 The Bidder may count toward its MBE/WBE/SDVE Participation Goals work granted to a second or subsequent tier subcontractor that is an MBE/WBE/SDVE Firm provided the MBE/WBE/SDVE Firm assumes the actual and contractual responsibility for performing work on the project. The Bidder may count toward its MBE/WBE/SDVE Participation Goals expenditures for materials and/or supplies obtained from an MBE/WBE/SDVE Firm, provided the MBE/WBE/SDVE Firm assumes the actual and contractual responsibility for the provision of the materials and/or supplies. To perform a commercially useful function, a supplier or manufacturer that is an MBE/WBE/SDVE Firm must be responsible for negotiating price, determining quality and quantity, ordering the material, installing (where applicable) and paying for the material itself.

14.4.3 An MBE/WBE/SDVE Firm does not perform a commercially useful function if its role is solely that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of participation. In determining whether a firm is such an extra participant, the Owner will examine similar transactions, particularly those in which MBE/WBE/SDVE Firms do not participate.

14.4.4 A Bidder that is a certified MBE/WBE/SDVE may count one hundred percent 100% of the contract amount towards the applicable MBE/WBE/SDVE Participation Goal, less any amount awarded to another MBE/WBE/SDVE Firm. For projects with separate MBE/WBE/SDVE Participation Goals, the Bidder will be required to obtain participation in the other categories for which it is not certified through participation by subcontractors, suppliers, or manufacturers. Therefore, an MBE Bidder is expected to obtain the required WBE and SDVE participation; a WBE Bidder is expected to obtain the required MBE and SDVE participation; and a SDVE Bidder is expected to obtain the required MBE and WBE participation.

14.4.5 If the Bidder is a joint venture and the joint venture itself is certified as a MBE/WBE/SDVE Firm, the joint venture may count toward the MBE/WBE/SDVE Participation Goals that portion of the total dollar value of the work equal to the percentage of the ownership and control of the MBE/WBE/SDVE Firm that is a participant in the joint venture. When a MBE/WBE/SDVE Firm performs work as a participant in a joint venture where the joint venture is **not** separately certified as an MBE/WBE/SDVE Firm, only the portion of the Contract Sum equal to the distinct, clearly defined portion of the work that the MBE/WBE/SDVE Firm performs with its own forces shall count toward the MBE/WBE/SDVE Participation Goals.

14.4.6 If an MBE/WBE/SDVE Firm is certified in more than one category, that MBE/WBE/SDVE Firm may be used to satisfy more than one MBE/WBE/SDVE Participation Goal, provided that the MBE/WBE/SDVE Firm is awarded a sufficient percentage of the contract work to meet or exceed all applicable MBE/WBE/SDVE Participation Goals.

14.5 Certification of MBE/WBE/SDVE Firms

14.5.1 The Bidder shall submit, within forty-eight (48) hours of the time for receipt of bids, to the University Contracting Officer, the information requested in the "MBE/WBE/SDVE Compliance Evaluation Form" for every MBE/WBE/SDVE Firm the Bidder intends to award work to under the contract to meet the MBE/WBE/SDVE Participation Goals.

14.5.2 The Bidder is responsible for obtaining information regarding the certification status of an MBE/WBE/SDVE Firm. Firms must be certified as an MBE, WBE or SDVE, as applicable, by the State of Missouri, Office of Administration as of the date of bid opening.

14.6 MBE/WBE/SDVE Participation Waiver

14.6.1 The Bidder is required to make a good faith effort to locate and contract with MBE/WBE/SDVE Firms. If a Bidder has made a good faith effort to secure the required MBE/WBE/SDVE Participation and has failed, the Bidder shall submit within forty-eight (48) hours of the time for receipt of bids, to the University Contracting Officer the information requested in "Application for MBE/WBE/SDVE 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 MBE/WBE/SDVE Participation

Goal(s). 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 meet the MBE/WBE/SDVE Participation Goal(s) may be awarded the contract regardless of the actual percent of MBE/WBE/SDVE Participation, provided that the Bid is otherwise acceptable and is determined to be the lowest, responsive, responsible Bid.

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

14.6.2.1 The bidder's attendance at pre-bid conferences for the solicitation;

14.6.2.2 The bidder's efforts and methods to provide M/WBEs and SDVEs with full sets of plans, specifications, or appropriate information in a timely manner to assist the M/WBE or SDVE in responding to the bidder's solicitation. This could include conducting market research to identify M/WBEs and SDVEs, and providing emails or written notices to all certified M/WBEs listed in OA's directory and listed SDVEs that specialize in the areas of work desired and which are located in the applicable area or surrounding areas as early in the acquisition process as practicable. Pro forma mailings to M/WBEs or SDVEs requesting bids are not alone sufficient to satisfy good faith efforts;

14.6.2.3 The bidder's efforts to make initial contact with at least three (3) M/WBEs and SDVEs for each category of work to be performed, its follow up with those contacted, and whether the bidder received a proposal for those categories of work;

14.6.2.4 The bidder's efforts to assist interested M/WBEs and SDVEs in obtaining bonding, lines of credit, or insurance or the efforts made to assist in obtaining necessary equipment, supplies, materials, or related assistance or services;

14.6.2.5 The extent to which the bidder divided work into projects suitable for subcontracting to M/WBEs and SDVEs including, where appropriate, breaking out contract work items into economically feasible units, for example, smaller tasks or quantities to facilitate M/WBE or SDVE participation, even when the bidder might otherwise prefer to perform the work with its own forces. Prime contractors are not, however, required to accept higher quotes from M/WBEs or SDVEs if the price difference is excessive or unreasonable, but the fact that there may be some additional costs involved in finding and using M/WBEs or SDVEs is not in itself sufficient reason for a bidder's failure to meet the contract M/WBE or SDVE percentage, as long as such costs are reasonable;

14.6.2.6 The bidder's ability to provide sufficient evidence in the form of documentation that supports the information provided;

14.6.2.7 The reasons provided by the bidder for the inability to reach a contract percentage and the ability of other bidders to meet the percentages, if applicable;

14.6.2.8 Actual past participation of M/WBEs and SDVEs achieved by the bidder; and

14.6.2.9 The rejection of an M/WBE or SDVE solely because its quotation for work was not the lowest received is not a sufficient good faith effort. However, a bidder is not required to accept an excessive or unreasonable quote in order to satisfy contract percentages.

Submittal of Forms

14.7.1 Within forty-eight (48) hours of the time for receipt of bids, the apparent low Bidder shall submit to the University Contracting Officer all MBE/WBE/SDVE Compliance Evaluation Form(s), and/or Application for Waiver with supporting information, and an "Affidavit of MBE/WBE/SDVE Participation" for every MBE/WBE/SDVE Firm the Bidder intends to award work on the contract. The affidavit will be signed by both the Bidder and the MBE/WBE/SDVE Firm. Failure to submit the documents in the time indicated may result in rejection of the Bid.

Additional Bid/Proposer Information

14.8.1 The Contracting Officer reserves the right to request from the apparent low Bidder additional, clarifying information regarding the Bidder's MBE/WBE/SDVE Participation and supporting documentation. The Bidder shall respond in writing to the Contracting Officer within twenty-four (24) hours of a request.

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

14.8.3 The Bidder shall provide to the Owner information related to the MBE/WBE/SDVE Participation included in the Bidder's proposal, including, but not limited to, the complete Application for Waiver, evidence of certification of participating MBE/WBE/SDVE Firms, dollar amount of participation of MBE/WBE/SDVE Firms, information supporting a good faith effort as described above, and a list of all MBE/WBE/SDVE Firms that submitted bids to the Bidder with the MBE/WBE/SDVE Firm's price, and the name and the price of the firm awarded the scope of work.

15. List of Subcontractors

15.1 If a list of subcontractors is required on the Bid Form, the Bidder shall list the name, city, and state of the firm(s) that will accomplish that portion of the contract requested in the space provided. This list is separate from both the list of MBE/WBE/SDVE Firms required in Section 15.2 and the complete list of subcontractors required in Section 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.

15.2 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 forty-eight (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 errors in the Bid, a listed subcontractor's inability to perform the work, etc. Any request to change a listed subcontractor shall include at a minimum, a 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.

15.3 Upon award of the contract, the requirements of Article 10 herein and Article 5 of the General Conditions of the Contract for Construction will apply.

University of Missouri

General Conditions

of the

Contract

for

Construction

June 2025 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 Owner is The Curators of the University of Missouri. The Owner may act through its Board of Curators or any duly authorized committee or representative thereof. The Owner may also be referred to herein as "University".

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

performed 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 Minority Business Enterprises (MBE)

Minority Business Enterprise (MBE) shall have the meaning set forth in Section 37.020, RSMo and the implementing regulations promulgated by the State of Missouri, Office of Administration.

1.1.9 Women Business Enterprise (WBE)

Women Business Enterprise (WBE) shall have the meaning set forth in Section 37.020, RSMo and the implementing regulations promulgated by the State of Missouri Office of Administration.

1.1.10 Service-Disabled Veteran Enterprise (SDVE)

Service-Disabled Veteran Enterprise (SDVE) shall have the same meaning as "Service-Disabled Veteran Business" set forth in Section 34.074, RSMo and the implementing regulations promulgated by the State of Missouri, Office of Administration.

1.1.11 MBE/WBE/SDVE Firm

MBE/WBE/SDVE Firm shall mean a business entity that is certified as an MBE, WBE, and/or SDVE by the State of Missouri, Office of Administration.

1.1.12 Work

Work shall mean supervision, labor, equipment, tools, material, supplies, incidentals operations and activities required by the Contract Documents or reasonably inferable by the 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.

1.1.13 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.

1.1.14 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.

1.1.15 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.

1.1.16 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.

1.1.17 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.

1.1.18 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.

1.1.19 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.

1.1.20 Day

The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

1.1.21 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.

1.1.22 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 the Architect in connection with Substantial Completion of the Work or a portion of the Work, which the Owner's Representative or the Architect has designated as remaining to be performed, completed, or corrected before the Work will be accepted by the Owner.

1.1.23 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 the 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 the 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 the 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. The 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. The Owner's lifting of Stop Work Order shall not prejudice the 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, the 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 the Owner.

2.4 Extent of Owner Rights

2.4.1 The rights stated in 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 all actions 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 (which may be 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.

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, corporation, or joint venture or other business entity, 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 3.18 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. The 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 the Contractor to comply with the provisions of this Paragraph shall cause the Contractor to forfeit any right to an adjustment of the Contract Sum or Contract Time for any postponement, rescheduling or other delays ordered by the 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** The 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 the 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 the 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 the Contractor's 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 the Contractor.

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 other entity or 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 the 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 exiting utilities, shall not encroach on neighboring property, and shall exercise caution to prevent damage to existing structures.

3.5.2 Only materials and equipment, which are to be used directly in the Work, shall be brought to and stored on the Work site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Work site. Protection of construction materials and equipment stored at the Work site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

3.5.3 No project signs shall be erected without the written approval of the Owner's Representative.

3.5.4 The Contractor shall ensure that the Work is at all times performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. Particular attention shall be paid to access for emergency vehicles, including fire trucks. Wherever there is the possibility of interfering with normal emergency vehicle operations, the 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, the 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. The 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 the 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 the Owner and shall at once report in writing to the Architect and the 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 the 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 the Owner's Representative within twenty-four (24) hours. During the progress of the Work, the Contractor shall verify all field measurements prior to fabrication of building components or equipment and proceed with the fabrication to meet field conditions. The 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 the Owner's Representative and the Architect. The 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 Contractor's own expense, but only as directed by the Architect, through the Owner's 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 six (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, the Contractor acknowledges that cutting and patching of the Work is essential for the Work to be successfully completed. The 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, the 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 the 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, the 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 the 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 the Contractor refuses to assume or perform, or delays in assuming or performing the 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 the Contractor whether or not an Indemnitee has made such demand. Even if a defense is successful to a claim or demand for which the Contractor is obligated to indemnify the Indemnitees from under this Paragraph, the Contractor shall remain liable for all costs of defense.

3.9.2 The indemnity obligations of the 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. The Owner reserves the right to control the defense and settlement of any claim, action or proceeding which the Contractor has an obligation to indemnify the Indemnitees against.

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, the Architect's 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, the Contractor 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 its 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 3.13.

3.12.8.2 The 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 the Owner's Representative in sufficient time to allow the Architect and the 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 the Architect and the 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 the 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 the Contractor from its obligation to ensure that an "or equal" article, appliance, device, or material strictly complies with the requirements of the Contract Documents. The Contractor shall not propose "or equal" items in connection with Shop Drawings or other Submittals, and the 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 the 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 ninety (90) days of the Notice to Proceed. If the Contractor believes that this milestone is unreasonable for any submittal, the Contractor shall request an extension of this milestone, within sixty (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 ninety (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 the Contractor and the name and number of the Owner's project. Quantities of Samples shall be twice the number required for testing so that the Architect can return one set of the Samples. Materials delivered before receipt of Architect's approval may be rejected by the Architect and in such event, the Contractor shall immediately remove all such materials from the Work site. When requested by the Architect or the 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. The Contractor shall also coordinate each Submittal with other Submittals.

3.14.10 The 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 the Contractor has satisfied its obligations under the Contract Documents with respect to the Contractor's review and approval of that Submittal. Each Submittal shall bear the signature of the representative of the 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, the Contractor acknowledges that the Architect's approval of Shop Drawings shall not relieve the Contractor for responsibility for errors and omissions in the Shop Drawings since the 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 the Owner or the Architect may reasonably request. The prints for Record Drawing use will be a set of "blue line" prints provided by the Architect to the Contractor at the start of construction. Upon Substantial Completion of the Work, the Contractor shall deliver all Record Drawings to the Owner and the Architect for approval. If not approved, the Contractor shall make the revisions requested by the Architect or the Owner's Representative. Final payment and any retainage shall not be due and owing to the Contractor until the final Record Drawings marked by the Contractor as required above are delivered to the Owner.

3.16.1 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.

.4.1 Recommended spare parts including catalog number and name of local suppliers or factory representative.

.4.2 Belt sizes, types, and lengths.

.4.3 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 Section 144.062, RSMo. The Contractor shall be issued a Project Tax Exemption Certificate for this Work to obtain the benefits of Section 144.062, RSMo.

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, the Owner shall be liable for the tax owed.

3.17.5 The Owner shall not be responsible for any tax liability due to the Contractor's neglect to make timely orders, payments, etc. or the Contractor's misuse of the Project Tax Exemption Certificate. The Contractor represents that the Project Tax Exemption Certificate shall be used in accordance with Section 144.062, RSMo and the terms of the Project Tax Exemption Certificate. The Contractor shall indemnify the Owner for any loss or expense, including but not limited to, reasonable attorneys' fees, arising out of the 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 the Architect's information the 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 the 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, the 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, the 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 the 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. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph 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. The Contractor shall be obligated to promptly proceed with such work. If the Contractor feels that it is entitled to additional compensation as a result of a Construction Directive, it may file a claim for additional compensation and/or time, in accordance with 4.4 of this Contract.

4.1.4 The Owner's Representative may, by written notice, require the Contractor to remove from involvement with the Work, any of the 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. The 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 the 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 the 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. The Contractor shall have the responsibility to substantiate Claims.

4.4.2 Claims by the 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 the Contractor. The notice of Claims shall also strictly comply with all other provisions of the Contract Documents. The 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. The Contractor shall furnish the Owner and the 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 the 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, the 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 the 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, the 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 (4) 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 contractual 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 contractual 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 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 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 (10) 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 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 Executive Director of Facilities Planning and Development, University of Missouri, 130 General Services Building, 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. The Contractor and the 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. The Contractor agrees not to file any complaint, petition, lawsuit or legal proceeding against the 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, the 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 the Contractor's work at the proper time. Each Contractor shall be required to coordinate the Contractor's 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 the Owner's or another Contractor's property done by the Contractor or the Contractor's employees, 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 the Contractor's 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 the 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, the 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 Order Requests 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 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 the 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). The 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, the Contractor shall promptly proceed with the change in the Work involved and advise the Owner of the 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 the Contractor's forces |
| 5% | To first tier Subcontractor on Work performed by his Subcontractor |

- .3 , extent, and complexity of 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 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. The 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 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 the 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 Contractor's 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, the 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 The Contractor acknowledges and agrees that time is of the essence of this Contract.

8.1.2 The 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, the Contractor shall be liable for such liquidated damages as set forth in Section 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 the 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 the Contractor provides 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 the 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 the 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 the Contractor or by acts or omissions of the Contractor or its Subcontractors of any tier or delays beyond the control of both the Owner and the 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, the Contractor shall provide written notice to the Owner within seven (7) calendar days of the event giving rise to such claim. The 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, the Contractor shall only be entitled to its actual direct costs caused thereby and the 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 the 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 the 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 the 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 the Contractor's 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. The 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

9.1.4 In the event the Contractor fails to provide the Owner such documents, the 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 the Contractor access to the site as a result of the Contractor's failure to provide such documents and the Contractor shall not be entitled to an adjustment of the Contract Time or Contract Sum as a result of its failure to provide the Owner the required documents

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 the Contractor represent and warrant that the person signing the Contract has the legal authority to bind the 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 the 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. The 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). The 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 the 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 the 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 the 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. The 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 the 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 Contract, offsite is defined as any location not owned or leased by the Owner. The Contractor shall submit a list of materials that they are requesting payment for offsite storage within sixty (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** The 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 (45) 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. The 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 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. The Owner shall hold the remaining five (5) or ten (10) percent, as applicable, as retainage until Substantial Completion of the work as set forth in 9.9.3 below.

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 to the 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, the 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 the Contractor;
- .8** The Contractor's failure to comply with applicable laws;
- .9** The Contractor's or Subcontractor's failure to comply with applicable wage requirements; or
- .10** The 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 the Contractor for amounts due and approved by the 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 the Contractor, Applications for Payment submitted by the Contractor shall indicate the actual percentage of completion of each portion of the Contractor's Work as of the end of the period covered by the Application for Payment.

9.7.5 Within fifteen (15) days following receipt payment from the Owner, the Contractor shall pay each Subcontractor and supplier 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. If the Owner, the architect or engineer of record, and the Contractor all determine that a particular Subcontractor's portion of the Work has been satisfactorily completed, including corrective work and closeout requirements, payment equal to one hundred percent (100%) of the subcontract amount for that Subcontractor can be made to the Contractor prior to Substantial Completion. The Contractor shall request such adjustment as necessary to enable the Contractor to pay the Subcontractor in full. This does not relieve the Contractor of any responsibilities under the terms of the Contract and any deficiencies subsequently discovered shall be corrected at no cost to the Owner.

9.7.6 Neither the Owner nor the 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 the 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 the Owner, and no other person, firm or corporation shall have any claim or right whatsoever thereto.

9.7.7 An approval for payment by the 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 the 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. If the Owner's Representative determines the work is not substantially completed and accepted, then the Owner or the Owner's Representative shall provide a written explanation of why the work is not considered substantially completed and accepted within fourteen calendar days to the Contractor, who shall then provide such notice to the subcontractor or suppliers responsible for such work. 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 the 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 release the retainage, increasing the 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 the 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 the 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 the 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, the Owner's Representative will return the Contractor's Final Application for Payment to the 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 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 the Contractor of its final payment, by check or electronic transfer, shall be and operate as a

release of all claims of the Contractor against the Owner for all things done or furnished or relating to the Work and for every act or alleged neglect of the 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 the Owner's receipt of Contractor's Final Application for Payment which satisfies all the requirements of the Contract Documents and the 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 the 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 The Contractor and all Subcontractors to the Contract must require all on-site employees to complete the ten-hour construction safety training program required under Section 292.675, RSMo, unless they have previously completed the program and have documentation of having done so. The Contractor will forfeit a penalty to the Owner of \$2,500 plus an additional \$100 for each employee employed by the Contractor or Subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training." (Section 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 the 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 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 the 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 the Architect. The Contractor shall hold regularly scheduled safety meetings to instruct the Contractor's 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 AND BONDS

11.1 Insurance

11.1.1 The 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 the Contractor, the 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 the Owner, but, regardless of such approval, it shall be the responsibility of the Contractor to maintain the insurance coverages set forth herein.

11.1.2 The Contractor shall not be allowed on the Owner's property without proof of the insurance coverages set forth herein

11.2 Commercial General Liability

11.2.1 The Contractor shall secure and maintain from the date of the Contract, and for a period of at least ten (10)

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 must apply per project. An umbrella policy may be used to satisfy these limits.

11.2.2 CGL insurance shall be written on a Commercial form CG 00 01 or an equivalent form providing the same coverages 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 Contractor waives all rights against the 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 The 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 the 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 The Contractor waives all rights against the 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 The Contractor shall purchase and maintain workers' compensation insurance and employers' liability insurance which shall protect the Contractor from claims for injury, sickness, disease or death of the 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 subcontracted, the Contractor shall require any Subcontractor of any tier to provide the insurance coverages required under this Paragraph.

11.4.2 The Contractor's workers' compensation insurance coverage shall be in compliance with all applicable laws, including the statutes of the State of Missouri. The 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 General Insurance Requirements and Professional Liability

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, in a claims made form, 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 claim/\$1,000,000.00 aggregate.

11.5.2 "The officers, employees, and agents of The Curators of the University of Missouri" shall be added as Additional Insured with respect to the CGL, umbrella/excess and Automobile Liability policies required herein. A certificate of insurance evidencing all coverage required is to be provided at least ten (10) days prior to the inception date of the Contract between the Contractor and the University. The Contractor is required to maintain coverages as stated and required to notify the University of a carrier change or cancellation within two (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. The Contractor shall request that its insurer(s) include the following disclaimer in any insurance policy, rider or endorsement issued pursuant to this Additional Insured requirement: "Neither the requirement for Additional Insured status nor any of the Contractor's action in compliance with such requirement, either direct or indirect, is intended to be and neither shall be construed as a waiver of any sovereign immunity, governmental immunity or any other type of immunity enjoyed by The Curators of the University of Missouri, the Board of

Curators of the University of Missouri, or any of its officers, employees or agents."

The Additional Insured status must be conveyed by using the ISO CG 20 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.

11.5.3 All insurance coverages procured by the Contractor shall be provided by agencies and insurance companies acceptable to and approved by Owner. All insurance coverage shall be provided by insurance companies that are duly licensed to conduct business in the State of Missouri as an admitted carrier, except that the Professional Liability insurance required herein may be provided by any insurance company legally authorized to do business in the State of Missouri. The form and content of all insurance coverage provided by the Contractor are subject to the approval of the Owner. All required insurance coverages shall be obtained and paid for by the Contractor. Any approval of the form, content or insurance company by the Owner shall not relieve the Contractor from the obligation to provide the coverages required herein. 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 the Contractor covering the Additional Insureds shall be primary insurance and any insurance maintained by Owner shall be excess insurance.

11.5.4 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. The Contractor shall cause its insurance carriers for all required coverages, except for workers' compensation, to waive all rights of subrogation against the Owner and its officers, employees and agents.

11.5.5 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. The Contractor is required to maintain coverages as stated and required to notify the University of a carrier change or cancellation within two (2) business days. The University reserves the right to request a copy of the policy. The 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.

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

11.5.7 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 the Contractor's exercise or enforcement of any rights under the Contract Documents.

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

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

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

11.5.11 By requiring the insurance set forth herein and in the Contract Documents, the Owner does not represent or warrant that coverage and limits will necessarily be adequate to protect the Contractor, and such coverages and limits shall not be deemed as a limitation on the Contractor's liability under the indemnities granted to the Owner in the Contract Documents. For those policies requiring the Owner to be added as an Additional Insured, as set forth herein, the Owner and all other indemnified parties shall be an Additional Insured for the full limits carried by the Contractor, not just the limits required herein.

11.5.12 If Contractor's liability policies do not contain a standard separation of insureds provision, such policies shall be endorsed to provide cross-liability coverage.

11.5.13 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; 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.

11.5.14 It is understood and agreed that the insurance coverages required by the provisions of this Contract are required in the public interest and that the Owner does not assume any liability for acts of the 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, the 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 the 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. 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, the 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 the Owner to the 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 the 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 or other insurance applicable to the Work, except such rights as they have to proceeds of such insurance. The Owner or the 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 the 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. The Contractor shall waive its rights to subrogation for any loss or damage to the Contractor's property or equipment coverage in favor of the Owner and other indemnified parties.

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 the Contractor's faithful performance of this Contract, including but not limited to the 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 the 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 Section, the Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to the Owner. If Contractor fails to make such substitution, the Owner may procure such required bonds on behalf of the Contractor at the 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 the 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 The 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 the 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 the 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 the Architect or the Owner's Representative, the Architect or the 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." The 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 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 The 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 the 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, the 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, the 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, the 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 the Architect.

13.3.5 The 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 The 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 the Architect or the Owner with a reasonable belief that additional defective Work may be found, in which case the Contractor shall be responsible for all costs of tests and inspections ordered by the Owner or the Architect, whether or not such tests or inspection reveals that Work is in compliance with the Contract Documents.

13.4 Nondiscrimination

13.4.1 In connection with the furnishing of equipment, supplies, and/or services under the Contract, the Contractor and all subcontractors shall not discriminate against any recipients of services, or employees or applicants for employment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, or any other status protected by applicable state or federal law.

13.4.2 The University serves from time to time as a contractor for and/or receives grant funding from the United States government and/or State of Missouri. Accordingly, the Contractor shall comply with all applicable state and federal laws, rules, regulations and executive orders applicable to subcontractors of government contractors or to contractors of grant recipients, including those relating to equal employment of minorities, women, persons with disabilities, certain veterans and based on sexual orientation and gender identity, as each may be amended from time to time. Contract clauses required by the

United States government or State of Missouri in such circumstances are incorporated herein by reference.

13.5 MBE/WBE/SDVE Participation Goals

13.5.1 The Contractor shall provide participation of MBE/WBE/SDVE Firms in the Project, through self-performance, if a MBE/WBE/SDVE Firm, or by subcontracting with MBE/WBE/SDVE Firms as Subcontractors, suppliers or manufacturers, in an amount that is no less than the percent of the Contract Sum that was promised in the Contractor's bid and/or the amount accepted by the Owner.

13.5.2 If the Contractor must remove any MBE/WBE/SDVE Firm as a Subcontractor, supplier or manufacturer under the Contract, the Contractor shall replace the MBE/WBE/SDVE Firm with one or more MBE/WBE/SDVE Firms in an amount equal to the dollar value of the work awarded to the MBE/WBE/SDVE Firm that was removed. The Contractor shall immediately notify the Owner's Representative in writing of the Contractor's intent to remove any MBE/WBE/SDVE Firm as a Subcontractor, supplier or manufacturer, and the Contractor's plan to provide the promised amount of MBE/WBE/SDVE Participation. All changes of a MBE/WBE/SDVE Firm as a Subcontractor of any tier, supplier or manufacturer under the Contract shall be approved by the Executive Director of Facilities Planning and Development.

13.5.3 If the Contractor fails to meet or to maintain the promised amount of MBE/WBE/SDVE Participation, the Contractor shall immediately notify in writing the Owner's Representative and the Executive Director of Facilities Planning and Development. Such notice shall include a description of the Contractor's good faith effort to provide the promised MBE/WBE/SDVE Participation.

13.5.4 If the Executive Director of Facilities Planning and Development finds that the Contractor has failed to comply in good faith with the promised MBE/WBE/SDVE Participation the Executive 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 In the enforcement of the non-discrimination requirements in Section 13.4 and 13.5, 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 MBE/WBE/SDVE Participation for each MBE/WBE/SDVE Firm at the end of the project stating the actual amount paid to the MBE/WBE/SDVE Firm.

13.6 Wage Rates (If the Contract amount is less than \$75,000, the requirements of this Section will not apply. Any adjustments that increase the Contract cost above \$75,000 will be subject to this Section, per Section 290.230, RSMo.)

13.6.1 The Contractor and its Subcontractors shall pay all workers performing work under the Contract not less than the prevailing hourly rate of wages or the public works contracting minimum wage, whichever is applicable, as set out in the Annual Wage Order that is attached to and made part of the specifications for work under the Contract, in accordance with Sections 290.210 to 290.340, RSMo (Missouri Prevailing Wage Law) and related regulations. The Annual Wage Order(s) published by the Missouri Department of Labor and Industrial Relations (MDLIR) for the location where the Work is performed is incorporated into the Contract by this reference. The Contractor shall use applicable MDLIR regulations, including, but not limited to, 8 CSR 30-3.010-3.060, 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 Executive Director of Facilities Planning and Development.

13.6.2 If this Project is financed in whole or in part from Federal funds (as indicated in the bid or Contract Documents), then this Contract shall be subject to all applicable federal labor statutes, rules, and regulations, including provisions of the Davis-Bacon Act, 40 U.S.C. § 3141 et seq., and the "Federal Labor Standards Provisions." Where the Missouri Prevailing Wage Law and the Davis-Bacon Act require payment of different wages for work performed under this Contract, the Contractor and all Subcontractors shall pay the greater of the wages required under either law, on a classification-by-classification basis.

13.6.3 The Contractor will forfeit a penalty to the Owner of \$100 per day (or portion of a day) for each worker that is paid less than the specified rate for any work done under the Contract by the Contractor or by any Subcontractor. The Owner shall deduct from any unpaid amounts then or thereafter due the Contractor under the Contract all sums and amounts due and owing as a result of any violation of Sections 290.210 to 290.340, RSMo. (Section 290.250, RSMo) The Contractor agrees to abide by any decision made by the Owner regarding underpayment of wages to workers and amounts owed them as well as penalties for underpayment of wages.

13.6.4 The prevailing wage rate(s) and public works contracting minimum wage(s) included in the Annual Wage Order(s) include fringe benefits as set forth in Sections 290.219 and 290.257, RSMo. 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 Section 290.210(5), RSMo.

13.6.5 The Contractor shall make full payment of the applicable required wages to workers in legal tender. 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 as fair and reasonable in accordance with Section 290.315, RSMo.

13.6.6 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. Do not include personal social security numbers in payroll records. 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 ten (10) days of the Owner's written request. The Contractor shall provide copies of workers I-9 forms within twenty-four (24) hours of written notice. 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. Falsification of the certified payroll records may result in the debarment of the Contractor or Subcontractor from future work with the University.

13.6.7 If applicable, the Contractor shall comply with the Copeland "Anti-Kick Act, 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.

13.6.8 The Contractor shall specifically incorporate the obligations of Section 13.6 into the subcontracts, supply agreements and purchase orders for the Work and require the same of any Subcontractors of any tier.

13.6.9 If Contractor fails to comply with the provisions of Section 13.6 of this Contract or with Sections 290.210 to 290.340, RSMo and related regulations, the Owner may, in its sole discretion, immediately terminate the Contract upon written notice. The rights and remedies of the Owner provided herein shall not be exclusive and are in addition to other rights and remedies provided by law or under this Contract.

13.6.10 The Contractor may pay entry-level workers or federally-registered apprentices fifty percent (50%) of the pay of a journeyman in their same occupational title, in accordance with Section 290.235, RSMo and 8 CSR 30-3.030. Per 8 CSR 30-3.030, an entry-level worker is "[a]ny worker who is not a journeyman and who is not otherwise enrolled in a federally-registered apprenticeship program but is participating in an on-the-job training program provided by the contractor for whom they perform work on a public construction project." The University of Missouri may require documentation showing, to the University's sole satisfaction, that an entry-level worker is participating in an on-the-job training program with the Contractor. The combined total of such entry-level workers and federally registered apprentices shall not exceed a one-to-one ratio with the number of journeyman workers in any occupational title on the project.

13.6.11 The Contractor shall post the wage rates for the Contract in a dry, accessible place at the field office on the project or, where there is no field office, at the Contractor's local office or batch plant so long as a copy is provided to workers upon request, as required by 8 CSR 30-3.050. The wage rates shall be kept in a clearly legible condition for the duration of the project.

13.6.12 Neither the Contractor, nor any Subcontractor of any tier, nor any person hired by them or acting on their behalf, shall request, demand or receive, either before or after such worker is engaged, that such worker pay back, return, donate, contribute, or give any part or all of said worker's wages, salary, or thing of value, to any person, upon the statement, representation, or understanding that failure to comply with such request or demand will prevent such worker from procuring or retaining employment, and no person shall, directly or indirectly, pay, request or authorize any other person to violate this Section as set forth in Section 290.305, RSMo, 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. 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 applicable wage rate as provided in the 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.

13.6.13 The Contractor will pay workers overtime for all hours worked over ten (10) hours per day and forty (40) hours per week in accordance with Section 290.230, RSMo. For all overtime work performed, not less than one and one-half 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. 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 in accordance with Section 290.230, RSMo. For purposes of this Section, 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. The Contractor and the 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 The Contractor and the 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 the Contractor and the Owner. The Contractor agrees that it shall not file any petition, complaint, lawsuit or legal proceeding against the Owner in any other court other than the State of Missouri Circuit Court for the County where the Project is located.

13.9.4 The Owner's total liability to the Contractor and anyone claiming by, through, or under the Contractor for any Claim, cost, loss, expense, or damage caused in part by the fault of the Owner and in part by the fault of The Contractor or any other entity or individual shall not exceed the percentage share

that the Owner's fault bears to the total fault of the Owner, the Contractor and all other entities and individuals as determined on the basis of comparative fault principles.

13.9.5 The Contractor agrees that the Owner shall not be liable to the Contractor for any special, indirect, incidental, or consequential damage whatsoever, whether caused by the 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. The 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 the 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. The Contractor shall not assign the Contract or proceeds hereof without written consent of the Owner. If the Contractor attempts to make such an assignment without such consent, it shall be void and confer no rights on third parties, and the Contractor shall nevertheless remain legally responsible for all obligations under the Contract. The Owner's consent to any assignment is conditioned upon the 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 Certifications

13.10.1 Suspension and Debarment

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 department or agency in accordance with Federal Executive Orders 12549 (2/18/86) and 12689 (8/15/89).

13.10.2 Anti-Discrimination Against Israel Act

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.

13.10.3 Byrd Anti-Lobbying Amendment

- .1** If this Contract exceeds \$100,000 and is funded by Federal funding, Contractor agrees to file the required certification, in compliance with 31 U.S.C. § 1352 (as amended).
- .2** Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352.
- .3** Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

13.10.4 Work Authorization

The Contractor and all subcontractors performing work under this Contract shall enroll and participate in a federal work authorization program operated by the United States Department of Homeland Security, E-Verify or an equivalent federal work authorization program, to verify information of newly hired employees, under the Immigration Reform and Control Act of 1986 (IRCA), P.L.99-603. By executing a contract with The Curators of the University of Missouri, the Contractor shall affirm its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted service and affirm that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services. The Contractor shall maintain documentation of its participation in a federal work authorization program and make such documentation available to the University upon request.

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 the 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, the Architect, or the 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 the Contractor and the 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 Section 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 Architect's services and expenses made necessary thereby, such excess will be paid to the Contractor; but, if such expenses of the 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 Section 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 Section 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 Section 14.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Section 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 ++

SECTION 1.E

SPECIAL CONDITIONS

1. DEFINITIONS

a. "Drawings"

Drawings referred to in and accompany Project Manual consist of Drawings prepared by and bearing the name of the below defined Architect, bearing Date of DECEMBER 22, 2025, entitled "BINGHAM HALL – UPDATE COURTYARD AREA", project number CP231011.

b. Architect
International Architects Atelier
912 Broadway, Suite 300
Kansas City, MO 64105
P: 816-471-6522

c. Electrical Engineer
Custom Engineering
912 Old Highway 63 South
Columbia, MO 65201
P: 573-875-4365

d. Structural Engineer
Bob D. Campbell & Company
4338 Bellview Ave.
Kansas City, MO 64111
P: 816.531.4144

e. Civil Engineer
Engineering Surveys & Services
1113 Fay St.
Columbia, MO 65201
P: 573-449-2646

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

2. SPECIAL SCHEDULING REQUIREMENTS

- a. Special scheduling requirements supplemental to the bid form.
- (1) Normal working hours are defined as weekdays between the hours of 7:00am and 5:00pm. Access and work efforts outside of these normal working hours to be coordinated with the Owner's

Representative.

- (2) Working Hours: Noisy work, as determined by the Owner's Representative, shall not commence before 8:00 a.m. when residence halls are occupied by students. For dates noted as quiet weeks in 2.d, noisy work is not allowed at any time. Any noisy work that is required outside of noisy work hours shall be coordinated with the Owner's Representative.
 - b. Critical path for long lead time items: Shop drawing submittals for critical path long lead time items shall be submitted with sixteen (16) days after award of a contract so as not to negatively impact the contractual substantial completion date.
 - c. Contractor may begin work on site upon issuance of contract.
 - d. Coordination around Student Activity and site access shall be arranged with the Owner's Representative and Department of Housing. Significant dates that will impact noisy work and require coordination include:
 - (1) May 8 – May 15, 2026: Quiet week (no noisy work)
 - (2) May 19, 2026: Hatch, Schurz, and College Avenue Halls are occupied through May 19, 2026.
 - (3) August 7, 2026: Student staff begin to return to campus (Hatch, Schurz, and College Avenue Halls are occupied).
 - (4) August 15, 2026: Students return to campus.
 - (5) August 15, 19 and 20, 2026: Coordinated move-in days.
 - (6) August 24, 2026: First day of classes.
 - (7) December 11 – December 18, 2026: Quiet week (no noisy work)
 - e. Coordinate permits for street closures and traffic control measures with City of Columbia. Allow a minimum of 30 days review time for closures or lane changes lasting more than 30 days. Contractor shall be responsible for obtaining all City required permits and coordinating City permit timelines with Construction scheduling. Contractor shall be responsible for permit cost.
3. SCOPE OF WORK
- a. The Contractor shall furnish all labor, materials, tools, equipment necessary for, and incidental to, construction of this project as indicated on 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) Project consists of the renovation of the exterior courtyard outside Bingham Commons.
- (2) Demolition shall consist of removal of the existing concrete and masonry site walls, concrete flatwork, light fixtures and underground storm drainage.
- (3) Architectural work shall consist of new plater areas, fixed furnishings and benches, and railings.
- (4) Structural work shall consist of new concrete retaining walls and flatwork.
- (5) Mechanical work shall consist of new underground storm water drainage system and new domestic water supply for irrigation system.
- (6) Electrical work shall consist of new site lighting and power receptacles.

4. LOCATION

- a. Work shall be performed under this Contract on the campus of the University of Missouri – Columbia, at Bingham Hall.

5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner's Representative will furnish the Contractor a copy of the executed Contract and a complete set of Drawings and Specifications in PDF format.
- b. The contractor may obtain printed sets from the architect at cost of reproduction.
- c. The Owner will furnish explanatory and changed Drawings to the Contractor in PDF format as issued during project.
- d. 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 reference 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 Locations
 - (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: 033000_01-Cast in Place Concrete.pdf
 - (2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.4) for the required submittal information.
- d. The Contractor shall submit to the Architect four (4) bound copies of all required Operating Instructions and Service Manuals 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. USE OF PREMISES

- a. Access: Access to construction site shall be as indicated on the drawings and as directed by the Owner's Representative.
- b. Parking:
 - (1) The Owner will issue Contractor two (2) service vehicle parking permits for use in University Parking lot AV-11. 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 contractor's 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) Sidewalk(s) and Hardscape – Parking/driving on hardscapes is strictly prohibited unless specifically directed by the Owner's Representative through the MU sidewalk permitting process. Restricted use permits will be limited to activities that are constrained by an absolute need to access from a sidewalk. Such activities shall be considered the exception and not the norm. Adequate signage, fencing and alternate routes must be provided in the immediate and adjacent areas.
 - (5) 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.

- (6) 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.
 - (7) 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.
 - (8) Conley Avenue between Missouri Avenue and University Avenue and Hitt Street between University Avenue and the Memorial Union are designated for pedestrian use only during the work week between the hours of 8:15 AM and 3:45 PM. Unless otherwise indicated in the contract documents, this area is strictly off limits to vehicular traffic without authorization from the Owner's Representative.
- c. Storage of materials: The Contractor shall store all materials within project limits. The Contractor shall confine apparatus, materials, and operation of workers to location established by the Owner's Representative. The Contractor shall not unreasonably encumber premises with materials. In addition, storage trailer locations may be available within 1-1/2 miles of project site as directed by the Owner's Representative. Storage trailer locations shall be subject to approval by the Owner's Representative and are available to the Contractor without cost.
- d. Utilities: Drinking water, water required to carry on work, and 120-volt electrical power required for small tool operation may be obtained without cost to the Contractor from existing utilities at locations designated by the Owner's Representative. Provisions for obtaining power, including temporary extensions, shall be furnished, and maintained by the Contractor. Upon completion of work such extensions shall be removed and any damage caused by use of such extensions shall be repaired to satisfaction of the Owner's Representative, at no cost to the Owner.
- e. Restroom: The Contractor shall provide and maintain, in a sanitary condition, chemical type portable toilet facilities at work site for use by his personnel. Toilets and toilet location shall be subject to approval by the Owner's Representative.
- f. Smoking is prohibited at the University of Missouri and all properties owned, operated, leased or controlled by the University of Missouri. Violation of the policy is defined as the use of any tobacco or marijuana products, including e-cigarettes, cigarettes, and vaping.

- g. 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.
- h. Discharge to Sewer Request: The University of Missouri's MS4 permit and NPDES Storm Water Discharge Permits along with the City of Columbia's POTW Operating Permit as well as local ordinances, and state and federal environmental regulations prohibit hazardous materials from being disposed into either the storm water or sanitary sewer systems. Unless specifically approved, all chemical products such as paints, dyes, lawn care products, maintenance products, and oil is 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.
- i. All concrete waste material including washout water shall be totally contained and removed from the Owner's property.
- j. 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.

k. **"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.

8 PROTECTION OF OWNER’S PROPERTY

- a. The Contractor shall be responsible for repair of damage to building exterior and interior, drives, curbs, streets, walks, grass, shrubbery and trees, which was caused by workmen or equipment employed during progress of work. All such repairs shall be made to satisfaction of the Owner’s Representative, at no cost to the Owner, or reimburse the Owner if the Owner elects to make repairs. For landscape damage, the Owners shall make such repairs. Compensation for these repairs shall be determined by the Owner’s Representative using the “Valuation of Landscape Trees, Shrubs, and other Plants” as published by the International Society of Arboriculture, as last revised.
- b. Construction Project Fencing:
 - (1) Fencing requirements, as indicated on Drawings, shall be constructed of 9 or 11-gauge chain link not less than six (6) feet in height and not more than 2-inch mesh with posts spaced not more than ten (10) feet apart and all corner and gate posts imbedded in concrete. All other posts shall be sufficiently secured in ground to maintain proper and adequate support of fence. Fenced in area shall have at least two (2) access gates and all gates shall be lockable.
 - (2) Fence screening fabric shall be used on all perimeter fencing. Fabric shall be tiger striped, full height of the project fence, securely attached and properly maintained throughout the duration of the project.
 - (3) Using existing landmarks, lamp posts, trees or other Owner property for support of fencing is strictly prohibited unless a written waiver is obtained from Owner’s Representative.
 - (4) Use of ribbon, snow fence, chicken wire, rope, and wooden barricades as fencing is prohibited.

- (5) Fencing shall be maintained in an "as-installed" condition throughout the life of the project.
 - (6) The Contractor may use used fencing provided it is in good condition and is satisfactory to the Owner's Representative.
- c. Preserving and Protecting Existing Vegetation:
 - (1) Protection and compensation for damages:
 - (a) Trees and shrubs within work area designated to remain shall be protected from damage during construction by fixed chain link fencing or armoring as indicated on Drawings or specified herein. Plant protection devices shall be installed before work has begun and shall be maintained for duration of work unless otherwise directed by Owner's Representative.
 - (b) In the event that damage(s) to the Owner's trees, shrubs or vegetation occurs as a result of the Contractor's unauthorized operations, the Contractor shall pay or allow to the Owner compensation for said damage(s). Compensation 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.
 - (2) 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.
 - (3) 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.
 - (4) Removal and/or pruning of select landscape materials shall be performed by MU Landscape Services department.

9. SUBSTITUTIONS AND EQUALS

- a. Substitutions and equals are defined in Article 3 of the General Conditions.
- b. Use of materials, products or equipment other than those named and described in the Contract Documents are substitutions and/or equal. Substitutions and/or equals submitted during the bidding period shall be

received by both the Architect and the Owner at least ten calendar days prior to the date for receipt of bids. To be considered, bidder's proposal shall include a complete description of the proposed substitution and/or equal and a comparison of significant qualities of the proposed substitution and/or equal with those specified including drawings, performance and test data, and other information necessary for an evaluation. The Architect's decision on the approval or disapproval of a proposed substitution and/or equal shall be final.

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

11. CODES AND STANDARDS

- a. The Contractor shall comply with applicable codes and standards as listed in the General Conditions. The following codes and standards shall also apply:
- b. City of Columbia – Sewer Line Installation Standards – Department of Public Works

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

12. PERMITS

- a. The Owner 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 except as noted in Article 3.2 of the General Conditions.
- b. 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 30-2.065. Ther permit applications are available at <https://dfs.dps.mo.gov/programs/bpv/>.

13. SPECIALTIES

- a. Owner furnished topsoil: The contractor shall place Owner provided topsoil and grade to the finish elevation as indicated in the contract. The Owner will

deliver the topsoil to the project site in the quantity required. 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 and around utilities. Erosion control measures shall be maintained throughout and after topsoil placement.

- (1) The sub-grade is to be left at minus six inches (6") in all areas unless indicated otherwise. All planting bed sub-grades are to be left a minus eighteen inches (18"). The contractor is to remove all deleterious material from the sub-grade prior to placing topsoil. All subgrade areas shall contain at least 6" of subsoil, (ie. cover clean rock backfilled areas). All subgrade areas shall be "ripped" a minimum of 6" deep and a maximum of 12" apart in opposite directions with minimal tire traffic to follow. All exposed deleterious material and unacceptable rock shall be removed.
- (2) The contractor shall adjust all yard boxes valve boxes, pull boxes, cleanouts, and manhole lid rings etc. (includes irrigation, sewers, water and electric), to the indicated finish grade.
- (3) Final plantings will be by the Owner. The Owner will water and maintain all seed, sod and landscaping.

- b. Irrigation System: On new irrigation systems, only Hunter, Toro or Rain Bird products are to be considered.

14. PRE-BID INSPECTION

- a. All pre-bid inspections of work areas shall be scheduled with pre-bid inspection guide, telephone: **(573) 882-6800**

15. ROOF CERTIFICATION AND WARRANTY REQUIREMENT (NOT USED)

16. MODIFICATION TO INFORMATION FOR BIDDERS: BIDDERS STATEMENT OF QUALIFICATIONS (NOT USED)

17. MODIFICATIONS TO GENERAL CONDITIONS (NOT USED)

18. PROJECT SCHEDULING

- a. Contractor Schedule – Contractor is responsible for the schedule, that may be provided with in-house personnel or hired a third-party scheduling consultant. See Contractor Schedule Requirements included in these

documents.

b. Contractor Schedule Requirements

(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

(i) Drawings and general provisions of the Contract, including General Conditions' Article 3.18 shall apply to this Section.

(c) Stakeholders

(i) A Stake holder 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 Subcontractor(s).

(d) Weather

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

(ii) Rather than speculate as to what comprises "normal" weather at the location of the project, Contractor agrees that it will assume a total of 32 lost days, on weather sensitive activities of critical path work, 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.

- (iii) 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

- (iv) The Contractor shall notify the Owner's Representative via email on the same day a lost weather day occurs and shall maintain a log of weather days to be included in the Narrative described in 2.3.4 herein.

(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

(i) Schedule Development

Contractor shall prepare the Project Schedule using the latest version of Phoenix Project Management scheduling software or other software as approved by the Owner's Representative prior to receipt of bids.

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.

(ii) Schedule Updates

1. Schedule Updates will be conducted once a month, at a minimum. Actual Start and Finish dates should be recorded regularly during the month. Remaining Duration shall be updated as of the data date, just prior to Contractor's submittal of the updated data.
2. Contractor will copy the previous months schedule and will input update information into the new monthly update version.
3. 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:
 - (a) Review out of sequence progress, making adjustments as necessary.
 - (b) Add any fragnets necessary to describe changes or other impacts to the project schedule and
 - (c) Review the resultant critical and near critical paths to determine any impact of the occurrences encountered over the last month.

(iii)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.

(c) Progress Meetings

- (i) 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.

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

(2) 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. 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.

- (k) Total float is herein defined as the measure of leeway in starting or completing an activity without adversely affecting the planned project completion date.
- (l) Weather: Adverse weather that is normal for the area must be taken into account in the Contractor's Project Schedule. See 1.(d)(iii), above.
- (m) Force Majeure Event: Any event that delays the project but is beyond the control and/or contractual responsibility of either party.
- (n) Schedule shall include the following, in addition to Contractor's work.
 - (i) Phasing: Provide activity codes in the schedule to show how the sequence of the Work is affected by the following:
 1. Requirements for phased completion and milestone dates.
 2. Work by separate contractors.
 3. Work by the Owner
 4. Coordination with existing construction.
 5. Limitations of continued occupancies.
 6. Uninterruptible services.
 7. Partial occupancy prior to Substantial
 - 8. Area Separations: Use Activity Codes to identify each major area of construction for each major portion of the Work. For the purposed of the Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.
 - 9. Required delivery dates for Owner furnished equipment, if applicable
 - 10. Post substantial completion activities and closeout
 - 11. Floor or Level: Use separate activity codes to identify each floor or level.
 - 12. Subcontractor: Use Activity Codes to identify each subcontractor's work activities.

Completion.

13. Type Work or Craft: Use Activity Codes to identify the type of work, or craft that will execute each activity.

(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:
 - (i) 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.
 - (ii) After the addition of the impact activity(ies), 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.
 1. If the adjustments above 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.
 2. 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 allocated 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 may be considered for equitable adjustment. In review of time

extension requests for compensable days, the Owner will consider the actual number of weather days incurred.

(d) Home office expenditures and staff are NOT compensable.

19. PROJECT COORDINATION (NOT USED)

20. PROJECT PARTNERING (NOT USED)

21. VALUE ENGINEERING (NOT USED)

22. 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. Contractor shall use all MU forms for commissioning which can be found at <https://operations.missouri.edu/facilities/commissioning-forms>
- 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.

23. MECHANICAL, ELECTRICAL, PLUMBING (MEP) PRE-INSTALLATION MEETING(S) (NOT USED)

24. COST BREAKOUT FOR OWNER'S ACCOUNTING PURPOSES / SPEND DOWN PURPOSES (NOT USED)

25. PROJECT MANAGEMENT/COMMUNICATION REQUIREMENTS (NOT USED)

26. SAFETY PRECAUTIONS AND PROGRAMS (NOT USED)

27. 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 NFPA 51B.

- (1) Hot work shall be defined as any work involving burning, welding, grinding, cutting, or similar operations that are capable of producing sparks, initiating fires or explosions.
- (2) The Contractor shall utilize the hot work permit decision tree and procedures as outlined in NFPA 51B for all Hot Work operations.
- (3) A University of Missouri Hot Work Permit (see Appendix 1.I) shall be used on all hot work performed outside a designated hot work area. The University of Missouri 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.
- (4) 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.
- (5) 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.
- (6) Hot Work personnel shall consist of the following three roles: the Permit Authorizing Individual (PAI), the Hot Work Operator (person doing the work), and the Fire Watch personnel. Hot Work Operators shall not be utilized to perform Fire Watch duties. Fire watch and monitoring duration shall be as required on the University of Missouri hot work permit.

28. GENERAL REQUIREMENTS FOR CRANE AND HOISTING OPERATIONS (NOT USED)

29. CONSTRUCTION WASTE MANAGEMENT

- a. The goal of Construction Waste Management is to divert 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 materials from the project (including clean fill material). Report all material types and weights, where material was diverted, type of diversion, documentation of diversion (waste or recycling tickets), and applicable dates. In order to calculate the diversion percentage, total weights of all non-hazardous landfill material must be reported. This information

shall be updated monthly utilizing the [Construction Waste Management Worksheet](#). 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 Construction Project Manager.

- b. A summary worksheet is required prior to substantial completion.

30. WARRANTY WALKTHROUGH

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

END OF SECTION

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
024119	Proposed Protection Measures				
024119	Pre-Demolition Photographs				
030130	Product Data				
030130	Samples				
030130	Qualification Data				
030130	Product Test Reports				
030130	Quality-Control Program				
033000	Product Data				
033000	Design Mixtures				
033000	Steel Reinforcement Shop Drawings				
033000	Material Test Reports				
033000	Material Certificates				
034500	Product Data				
034500	Design Mixtures				
034500	Shop Drawings				
034500	Samples				
034500	Qualification Data				
034500	Material Certificates				

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
034500	Material Test Reports					
045000	Product Data					
045000	Quality Control Program					
045000	Masonry Treatment Program					
045000	Samples for Initial Selection					
045000	Field Constructed Mockups					
045000	Preconstruction Photographs					
055000	Product Data					
055000	Shop Drawings					
055000	Samples					
057300	Product Data					
057300	Shop Drawings					
057300	Samples					
057300	Delegated Design Submittal					
057300	Mill Certificates					
057300	Product Test Reports					
057300	Welding Certificates					

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
057300	Evaluation Reports					
071326	Product Data					
071326	Shop Drawings					
071326	Qualification Data					
079200	Product Data					
079200	Samples					
079200	Joint Sealant Schedule					
099600	Product Data					
099600	Samples					
099600	Product List					
129300	Product Data					
129300	Samples					
220529	Product Data					
220529	Welding Certificates					
220553	Product Data					
220719	Product Data					
221116	Product Data					

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
260519	Product Data					
260519	Product Schedule					
260529	Product Data					
260529	Welding Certificates					
260533	Product Data					
260533	Coordination Drawings					
260533	Seismic Qualification Data					
260553	Product Data					
262726	Product Data					
262726	Shop Drawings					
262726	Samples					
265000	Product Data					
265000	Shop Drawings					
265000	Samples					
265000	Coordination Drawings					
265000	Product Certificates					
265000	Product Test Reports					

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
311000	Existing Condition Documentation					
312000	Material Test Reports					
312000	Existing Condition Documentation					
321313	Product Data					
321313	Design Mixtures					
321313	Qualification Data					
321313	Material Certificates					
321313	Material Test Reports					
321373	Product Data					
321373	Samples					
321373	Paving-Joint Sealant Schedule					
321373	Product Certificates					
321373	Product Test Reports					
321373	Preconstruction Test Reports					
321723	Product Data					
328400	Product Data					
328400	Shop Drawings					

SECTION 1.E.3

SHOP DRAWING AND SUBMITTAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

<i>Section</i>	<i>Description</i>	<i>Contractor</i>	<i>Discipline Responsible</i>	<i>Date Received</i>	<i>Date Returned</i>	<i>Comments</i>
329250	Product Data					
329250	Shop Drawings					
329250	Samples					
329250	Qualification Data					
334200	Product Data					
334200	Shop Drawings					
334200	Product Certificates					

SECTION 1.E.4

OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
129300	Maintenance Data							
265000	Maintenance Data							
328400	Maintenance Data							
328400	Startup and Testing							

SECTION 1.E.5

CLOSEOUT LOG

Project: BINGHAM HALL – UPDATE COURTYARD AREA

Project Number: CP231011

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>
GC / 3.11	As-built drawings					
GC/13.5.6	Final Affidavit of MBE/WBE/SDVE Participation for each MBE/WBE/SDVE Firm					
SC/20	Executed commissioning plan w/ required documentation					
071326	Warranty					
079200	Warranty					
099600	Extra Materials					
220719	Field Quality Control Reports					
221116	Field Quality Control Reports					
260519	Field Quality Control Reports					
262726	Field Quality Control Reports					
265000	Warranty					
321313	Field Quality Control Reports					
334200	Field Quality Control Reports					

CP231011 Bingham Courtyard Updates Commissioning Check List

Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
Commissioning Items by CSI Division	Name	Firm			
1					
Building System Commissioning					
Commissioning Agent - Conduct pre-installation meetings per specifications.					Meeting Minutes <input checked="" type="checkbox"/>
24119					
Selective Demolition					
Return adjacent areas to condition existing before demolition operations began					Pre-construction video or digital photos <input checked="" type="checkbox"/>
30130					
Maintenance of Cast-In-Place Concrete					
Build Mockups as specified					Inspection Report <input checked="" type="checkbox"/>
Help Third Party Perform Field Quality Control section of specifications					Third Party Report <input checked="" type="checkbox"/>
33000					
Cast-In-Place Concrete					
Provide a Copy Of Field Cured Concrete Cylinder Test Report to Owner's Rep Prior to Stripping Any Load Bearing Formwork					Test Report From Independent Testing Lab <input checked="" type="checkbox"/>
Submit concrete mix designs prepared by a qualified testing laboratory for approval prior to placement.					mix design reports <input type="checkbox"/>
45000					
Exterior Masonry Restoration					
Build Mockups as specified					Inspection Report <input checked="" type="checkbox"/>

Commissioning Items by CSI Division		Verified by: Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
57300							
Decorative Metal Railings							
Provide welder qualification report for each welder on site						Welder Qualifications	<input checked="" type="checkbox"/>
71326							
Self-Adhering Sheet Waterproofing							
Contact Owner's Representative prior to backfilling to allow for inspection of damp/waterproofing.							<input checked="" type="checkbox"/>
Perform Field Quality Control section of spec.						test report	<input checked="" type="checkbox"/>
79200							
Joint Sealants							
Clean out joints immediately before installing joint sealant							<input checked="" type="checkbox"/>
99600							
High-Performance Coatings							
Perform Field Quality Control section of spec						Test Report	<input checked="" type="checkbox"/>
Provide Extra Material as specified						Transmittal	<input checked="" type="checkbox"/>
260519							
Low-Voltage Electrical Power Conductors and Cables							
Ensure Color is per spec							<input checked="" type="checkbox"/>

Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
Commissioning Items by CSI Division	Name	Firm			
260553					
Identification for Electrical Systems					
Verify all equipment, panels, conduits and conductors are correctly labeled.					<input type="checkbox"/>
260943					
Relay-Based Lighting Controls					
Factory rep shall provide start-up Per Field Quality Control and System Startup section of spec.				field report	<input checked="" type="checkbox"/>
Provide factory training				Sign in sheet	<input checked="" type="checkbox"/>
262726					
Wiring Devices					
Operate All Devices per Field Quality Control section of spec to verify correct operation				Test Report	<input checked="" type="checkbox"/>
265000					
LED Interior Lighting					
Perform Field Quality Control section of specifications				Test reports	<input checked="" type="checkbox"/>
Test Emergency and Exit Lighting fixtures for proper operation for 90 minutes				Test Report	<input checked="" type="checkbox"/>
311000					
Site Clearing					
Maintain dust control per contract documents					<input type="checkbox"/>
312000					
Earth Moving					
Help 3rd party with field quality control section of specs				Third Party Report	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division		Verified by: Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
321313							
Concrete Paving							
Help 3rd party with field quality control section of specs						Third Party Report	<input checked="" type="checkbox"/>
Concrete Paving							
Hold Pre-Installation meetings as specified						Meeting Minutes	<input checked="" type="checkbox"/>
321373							
Concrete Paving Joint Sealants							
Hold PreInstallation Meetings as specified						Meeting Minutes	<input checked="" type="checkbox"/>
321723							
Pavement Markings							
Perform Field Quality Control section of specs						Test Report	<input checked="" type="checkbox"/>
328400							
Planting Irrigation							
Perform Hydrostatic Testing Section of specs						Test Report	<input checked="" type="checkbox"/>
Provide testing and Inspection as specified in Field Quality Control section.						Test Report	<input checked="" type="checkbox"/>
334200							
Stormwater Conveyance							
Provide testing and Inspection as specified in Field Quality Control section.						Test Report	<input checked="" type="checkbox"/>

PLEASE FOLLOW LINK FOR CHECKLIST FORMS

<https://facilities.missouri.edu/planning-design-construction/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)

AM #1

Water – turned on to the first valve past Energy Management's last valve.

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

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

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

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

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

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

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

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

- ☐ Review all piping and equipment being turned on for proper installation and completed testing.
- ☐ Pressure test completed in piping being turned on.
- ☐ Insulation must be installed.
- ☐ Meter installed, working and connected to Metasys.
- ☐ 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

SECTION 1.F

INDEX OF DRAWINGS

Drawings referred to in and accompanying this Project Manual consist of the following sheets dated December 22, 2025.

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Sheet 4 of 54:	G003	SITE SURVEY
Sheet 5 of 54:	G004	SITE SURVEY
Sheet 6 of 54:	G005	SITE SURVEY
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Sheet 9 of 54:	C1.01	OVERALL PLAN
Sheet 10 of 54:	C2.01	DEMOLITION PLAN
Sheet 11 of 54:	C3.01	SITE PLAN
Sheet 12 of 54:	C4.01	GRADING & DRAINAGE PLAN – BASE BID
Sheet 13 of 54:	C4.02	GRADING & DRAINAGE PLAN – ALTERNATE 1 SEATING AREA “B”
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Sheet 15 of 54:	C4.04	GRADING & DRAINAGE PLAN – ALTERNATE 5 SEATING AREA “A”
Sheet 16 of 54:	C5.01	STORM SEWER PLAN – BASE BID
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Sheet 20 of 54:	C6.01	STORM SEWER PROFILE
Sheet 21 of 54:	C6.02	MODULAR SUSPENDED PAVEMENT SYSTEM SECTIONS
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Sheet 24 of 54:	C8.01	DETAILS
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Sheet 53 of 54:	E600	ELECTRICAL SCHEDULES & DETAILS
Sheet 54 of 54:	P100	PLUMBING PLAN

END OF SECTION

SECTION 1.G

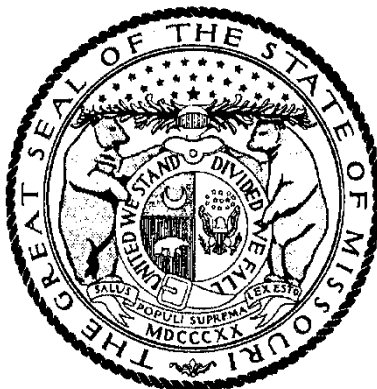
PREVAILING WAGE RATES

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

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MIKE KEHOE, Governor

Annual Wage Order No. 32

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

Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: March 10, 2025

Last Date Objections May Be Filed: April 9, 2025

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$61.64
Boilermaker	\$34.21*
Bricklayer-Stone Mason	\$57.33
Carpenter	\$54.00
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$47.94
Plasterer	
Communication Technician	\$60.91
Electrician (Inside Wireman)	\$60.73
Electrician Outside Lineman	\$83.75
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$34.21*
Glazier	\$57.72
Ironworker	\$72.58
Laborer	\$45.36
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$63.31
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$67.29
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$43.55
Plumber	\$72.49
Pipe Fitter	
Roofer	\$56.44
Sheet Metal Worker	\$58.82
Sprinkler Fitter	\$69.16
Truck Driver	\$34.21*
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.

Heavy Construction Rates for
BOONE County

Section 010

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$67.38
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$83.75
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$53.59
General Laborer	
Skilled Laborer	
Operating Engineer	\$69.61
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$34.21*
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: Provide Area 'B' with concrete paving, modular weathering steel planting walls with integrated benches and swing bench seating. Provide power and lighting associated with the area indicated, RE: Elect.
2. Additive Alternate No. 2: Provide sandblasted concrete texture in pattern indicated.
3. Additive Alternate No. 3: Provide Area 'C' with concrete paving and concrete walls with integrated benches. Provide power and lighting associates with the area indicated, RE: Elect.
4. Additive Alternate No. 4: Provide catenary lighting scheme in lieu of base bid lighting scheme, RE: Elect.
5. Additive Alternate No. 5: Provide Area 'A' with concrete paving and swing bench seating.

SECTION 1.I

UNIVERSITY OF MISSOURI HOT WORK PERMIT

University of Missouri HOT WORK PERMIT

Seek an alternative/safer method if possible

Before initiating hot work, ensure precautions are in place as required by NFPA 51B and ANSI Z49.1.
Make sure an appropriate fire extinguisher is readily available.

This Hot Work Permit is required for any operation involving open flame or producing heat and/or sparks. This work includes, but is not limited to, welding, brazing, cutting, grinding, soldering, thawing pipe, torch applied roofing, or chemical welding.

Date	Hot Work by: Employee <input type="checkbox"/> Contractor <input type="checkbox"/>
Location / Building / Floor / Room #:	Name (Print) and Signature of person doing Hot Work
Work to be performed:	I verify that the above location has been examined, the precautions marked on the checklist below have been taken, and permission is granted for this work.
Time Started	<input type="text"/>
Time Completed	<input type="text"/>
Time Fire Watch Completed	<input type="text"/>
Name (print) and signature of permit-authorizing individual (PAI)	
Name (print) and signature of person performing Fire Watch	

THIS PERMIT IS GOOD FOR ONE DAY ONLY

Yes	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	Available sprinklers, hose streams, and extinguishers are in service and operable.
<input type="checkbox"/>	<input type="checkbox"/>	Hot Work equipment is in good working condition in accordance with manufacturer's specifications.
<input type="checkbox"/>	<input type="checkbox"/>	Special permission obtained to conduct hot work on metal vessels or piping lined with rubber or plastic.
Requirements within 35 ft (11 m) of hot work		
<input type="checkbox"/>	<input type="checkbox"/>	Flammable liquid, dust, lint and oily deposits removed.
<input type="checkbox"/>	<input type="checkbox"/>	Explosive atmosphere in area eliminated.
<input type="checkbox"/>	<input type="checkbox"/>	Floors swept clean and trash removed.
<input type="checkbox"/>	<input type="checkbox"/>	Combustible floors wet down or covered with damp sand or fire-resistive / noncombustible materials or equivalent.
<input type="checkbox"/>	<input type="checkbox"/>	Personnel protected from electrical shock when floors are wet.
<input type="checkbox"/>	<input type="checkbox"/>	Other combustible storage material removed or covered with listed or approved materials (welding pads, blankets, curtains, fire-resistive tarpaulins), metal shields, or non-combustible material.
<input type="checkbox"/>	<input type="checkbox"/>	All wall and floor openings are covered.
<input type="checkbox"/>	<input type="checkbox"/>	Ducts and conveyors that might carry sparks to distant combustible material are covered, protected, or shut down.
Requirements for hot work on walls, ceilings or roofs		
<input type="checkbox"/>	<input type="checkbox"/>	Construction is noncombustible and without combustible coverings or insulation.
<input type="checkbox"/>	<input type="checkbox"/>	Combustible material on other side of walls, ceilings, or roofs is moved away.

Yes N/A

Requirements for hot work on enclosed equipment

- ☐ ☐ Enclosed equipment is cleaned of all combustibles.
- ☐ ☐ Containers are purged of flammable liquid / vapor.
- ☐ ☐ Pressurized vessels, piping, and equipment removed from service, isolated, and vented.

Requirements for hot work fire watch and fire monitoring

- ☐ ☐ Fire watch is provided with suitable extinguishers and, where practical, a charged fire hose.
- ☐ ☐ Fire watch is trained in use of equipment, sounding alarm, and notification of emergency contacts.
- ☐ ☐ Fire watch is required in adjoining areas, or above and below the work area.
- ☐ ☐ Per the PAI / fire watch, monitoring of hot work area is required, per the table below.

Construction Factors

	Noncombustible construction		Combustible construction without concealed cavities		Combustible Construction with unprotected concealed cavities	
Occupancy Factors	Fire Watch	Monitor	Fire Watch	Monitor	Fire Watch	Monitor
Noncombustible with any combustibles contained within closed equipment (e.g., ignitable liquid within piping)	30 minutes	0 hours	1 hour	3 hours	1 hour	5 hours
Office, retail or manufacturing with limited combustible loading	1 hour	1 hour	1 hour	3 hours	1 hour	5 hours

POST A COPY OF THIS PERMIT IN/NEAR THE HOT WORK AREA.

Admin: University employees shall file hot work permits in departmental safety file records.

Contract personnel shall file copies of permits in the University of Missouri Project Management File System.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes:
 - 1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
 - 2. Removal of existing items for reinstallation.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- B. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations.

1.5 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far

as practical.

- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.
 - a. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. On-site sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 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 ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
 - 2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

- 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.

1. Strengthen or add new supports when required during progress of selective demolition.
- B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- C. 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 and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
 1. Arrange to shut off utilities with utility companies.
 2. If disconnection of utilities and building systems will affect other buildings on the site, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
 3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.
 4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 5. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:
 - a. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL**A. Removed and Reinstalled Items:**

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL**A. General: Demolish and remove existing construction only to 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 watch during and for at least 1 hour after flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**A. Concrete:**

1. Demolish in sections. Cut concrete full depth at junctures with construction to remain and

at regular intervals using power-driven saw, and then remove concrete between saw cuts.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- 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.
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 030130 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Removal of deteriorated concrete and subsequent replacement and patching.
 - 2. Crack injection.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
- B. Samples for Initial Selection: Cured Samples for each exposed product and for each color and texture.
 - 1. Include sets of patching-material Samples in the form of briquettes, at least 3 inches long by 1-1/2 inches wide representative of the range of concrete colors on the building. Document each Sample with product, mix, and or other information necessary to replicate it.
 - 2. Include sets of Samples for crack-injection grout in the form of injection-treated, whole, dense concrete block units representative of the range of required adhesive colors.
 - 3. Have each set of Samples contain a close color range of at least three samples of different mixes of materials that match the variations in existing, adjacent concrete when cured and dry.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For concrete-maintenance specialist.
- B. Product Test Reports: For each cementitious patching mortar and crack-injection grout, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Quality-Control Program: Submit before work begins.

1.5 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Each packaged patching-mortar and crack-injection-grout manufacturer shall employ factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.
- B. **Concrete-Maintenance Specialist Qualifications:** Engage an experienced concrete-maintenance firm that employs installers and supervisors who are trained and approved by manufacturer to apply packaged patching-mortar and crack-injection grout to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.
- C. **Quality-Control Program:** Prepare a written plan for concrete maintenance to systematically demonstrate the ability of personnel to properly perform maintenance work, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.
- D. **Mockups:** Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. **Concrete Removal and Patching:** Remove and repair a 2 sq. ft. area of deteriorated concrete wall.
 - 2. **Crack Injection:** Perform epoxy crack injection in two separate areas, each approximately 12 inches long.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- B. Store cementitious materials off the ground, under cover, and in a dry location.
- C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.7 FIELD CONDITIONS

- A. **Cold-Weather Requirements for Cementitious Materials:** Do not apply unless concrete-surface and air temperatures are above 40 deg F (5 deg C) and will remain so for at least 48 hours after completion of Work.

- B. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Source Limitations: For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.2 PATCHING MORTAR

- A. Patching Mortar Requirements:
1. Only use patching mortars that are recommended by manufacturer for each applicable horizontal, vertical, or overhead use orientation.
 2. Color and Aggregate Texture: Provide patching mortar and aggregates of colors and sizes necessary to produce patching mortar that matches existing, adjacent, exposed concrete. Blend several aggregates if necessary to achieve suitable matches.
- B. Cementitious Patching Mortar: Packaged, dry mix for repair of concrete.
1. Basis of Design Product: Subject to compliance with requirements, provide Conproco; ISR-CM or equivalent product as approved by Architect.
 2. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C109.
 3. Tensile Strength: Not less than 530 psi at 28 days when tested according to ASTM C307.
 4. Water Absorption: 11 percent when tested according to ASTM C140.
 5. Color: Provide repair mortar selected from full range of manufacturer's standard colors and as approved in mockups.

2.3 CEMENTITIOUS CRACK-INJECTION MATERIALS

- A. Injection Grout: Cementitious repair grout designed for the repair of cracks ranging from hairline to 3/4 inch. The injection grout has a low viscosity which allows for excellent flowability to fill voids within concrete.
1. Basis of Design Product: Subject to compliance with requirements, provide Conproco; Injection Grout or equivalent product as approved by Architect.
 2. Clay: Non-staining clay as recommended by manufacturer for plugging injection ports.
 3. Color: Provide crack-injection grout that blends with existing, adjacent concrete and does not stain concrete surface as approved in mockups.
 4. Compressive Strength: Not less than 3800 psi after 28 days when tested according to ASTM C109.

5. Tensile Strength: Not less than 475 psi after 28 days.
6. Viscosity: 65-75 KU immediate lab.

2.4 MISCELLANEOUS MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I, II, or III unless otherwise indicated.
- B. Water: Potable.

2.5 MIXES

- A. General: Mix products, in clean containers, according to manufacturer's written instructions.
 1. Do not add water, thinners, or additives unless recommended by manufacturer.
 2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.
- B. Concrete: Comply with Section 033000 "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 CONCRETE MAINTENANCE

- A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.
- B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 EXAMINATION

- A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.
- B. Locate areas of deteriorated or delaminated concrete using hammer sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

3.3 PREPARATION

- A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.

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- B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.
1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
 2. Use only proven protection methods appropriate to each area and surface being protected.
 3. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.
 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete maintenance work.
 5. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
 6. Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.
 7. Protect floors and other surfaces along haul routes from damage, wear, and staining.
 8. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
 9. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 10. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.
1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- D. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.
1. Verify that affected utilities have been disconnected and capped.
 2. Inventory and record the condition of items to be removed for reinstallation or salvage.
 3. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain. Strengthen or add new supports when required during progress of removal work.
- E. Reinforcing-Bar Preparation: Remove loose and flaking rust from exposed reinforcing bars by abrasive blast cleaning or wire brushing until only tightly adhered light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in two or more adjacent bars, cut bars and remove and replace as indicated on Drawings.
2. Remove additional concrete as necessary to provide at least 3/4-inch clearance at existing and replacement bars.
3. Splice replacement bars to existing bars according to ACI 318 by lapping, welding, or using mechanical couplings.

3.4 REMOVAL OF CONCRETE

- A. Do not overload structural elements with debris.
- B. Saw-cut perimeter of areas indicated for removal to a depth of at least 1 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
- C. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
- D. Remove additional concrete if necessary to provide a depth of removal of at least 1 inch over entire removal area.
- E. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least 3/4-inch clearance around bar.
- F. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
- G. Provide surfaces with a fractured profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.
- H. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.5 INSTALLATION OF PATCHING MORTAR

- A. Place patching mortar as specified in this article unless otherwise recommended in writing by manufacturer.
 1. Provide forms where necessary to confine patch to required shape.
 2. Wet substrate and forms thoroughly and then remove standing water.
- B. Pretreatment: Apply bond coat of patching mortar.
- C. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
- D. Vertical Patching: Place material in lifts of not less than 1 inch. Do not feather edge.

- E. Consolidation: After each lift is placed, consolidate material and screed surface. Over-build final lift by 1/4 inch.
- F. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then shave to the final form after 2 hours and finish to a surface matching adjacent concrete.
- G. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.6 CRACK INJECTION

- A. Clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
- B. Clean areas to receive repairs of oil, dirt, and other substances that would interfere with bond.
- C. Place injection ports as recommended by manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with non-staining clay.
- D. Seal cracks at exposed surfaces with a ribbon of non-staining clay at least 1/4 inch thick by 1 inch wider than crack.
- E. Inject grout, beginning at lowest point of crack and working toward the top. Inject grout into ports to refusal, capping adjacent ports when they extrude grout. Cap injected ports and inject through adjacent ports until crack is filled.
- F. Keep repair zone damp for full 24 hour cure time.
- G. After grout has set, remove injection ports and grind surfaces smooth.

3.7 FINISHING FORMED SURFACES

- A. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Architectural Drawings:
 - 1. Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi
 - 2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
 - 3. Surface Continuity:
 - a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
 - b. Maintain required patterns or variances in depths of blast to match mockup.
 - 4. Abrasive Blasting:
 - a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.
 - b. Determine type of nozzle pressure and blasting techniques required to match field sample.
 - c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces on mockup for Architect's final approval of level of abrasive blasting, as follows:

- 1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
- 2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of 1/16 inch.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 1. Packaged, Cementitious Patching Mortar: Three randomly selected sets of samples for each type of mortar required, tested according to ASTM C928/C928M.
 2. Crack Injection: Core-drilled samples to verify proper installation.
 - a. Testing Frequency: Three samples from mockup and one sample for each 100 feet of crack injected.
 - b. Where samples are taken, refill holes with cementitious mortar.
- C. Product will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Manufacturers Field Service: Engage manufacturers' factory-authorized service representatives for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

END OF SECTION 030130

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Retaining walls.
- B. Related Sections include the following:
 - 1. Section 321313 "Cement Concrete Pavement" for concrete pavement and walks.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Curing compounds.
 - 4. Floor and slab treatments.
 - 5. Bonding agents.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Steel Reinforcement:** Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

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

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Available Products:
 - a. Burke by Edoco; BurkeFilm.
 - b. ChemMasters; Spray-Film.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - d. Dayton Superior Corporation; Sure Film.
 - e. Euclid Chemical Company (The); Eucobar.
 - f. Kaufman Products, Inc.; Vapor Aid.
 - g. Lambert Corporation; Lambco Skin.
 - h. L&M Construction Chemicals, Inc.; E-Con.
 - i. Meadows, W. R., Inc.; Sealtight Evapre.
 - j. Sika Corporation, Inc.; SikaFilm.
 - k. Symons Corporation, a Dayton Superior Company; Finishing Aid.
 - 2. Verify compatibility of evaporation retarder with floor finish system.
- B. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Available Products:
 - a. Burke by Edoco; Cureseal 1315 WB.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
 - d. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - f. Lambert Corporation; UV Safe Seal.
 - g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - h. Meadows, W. R., Inc.; Vocomp-30.
 - i. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
 - 2. Verify compatibility of curing and sealing compound with floor finish system.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations, for repair of floor and slab areas beneath floor coverings.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations, for repair of floor or slab areas remaining exposed and not receiving floor coverings.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

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- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
- B. Exterior Retaining Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi at 28 days.
 2. Minimum Cementitious Material Content: 560 lb/cu. yd.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8-inch for smooth-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Install dovetail anchor slots in concrete foundation walls where required for anchorage of face brick veneer.
 - a. Install anchor slots vertically at 24" o.c. maximum.

3.3 REMOVING AND REUSING FORMS

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

- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose

particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 50 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28

days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural precast concrete benches.

1.2 DEFINITIONS

- A. Design Reference Sample:** Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.3 ACTION SUBMITTALS

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

- B. Design Mixtures:** For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at corners.
5. Indicate all reinforcing and cast in hardware.
6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
7. Indicate relationship of architectural precast concrete units to adjacent materials.

- D. Samples:** Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 6 by 6 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For fabricator.

- B. Material Certificates:** For the following items:

1. Cementitious materials.
2. Admixtures.

- C. Material Test Reports: For aggregates.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for architectural precast concrete units to comply with performance requirements. Precast concrete manufacturer must have a minimum of 5 years of successful experience on projects of similar magnitude and complexity to the indicated project.
 - 1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or designated as an APA-certified plant for production of architectural precast concrete products.
- B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

1.6 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Subject to compliance with requirements, provide Wausau Tile;

Our Town Concrete Bench or alternate manufacturer as approved by Architect.

1. Bench Without Back: Provide WS900 series parts as required to match configurations shown on Drawings.
2. Bench With Back: Provide WS913 series as required to match configuration shown on Drawings.

2.2 PERFORMANCE REQUIREMENTS

- A. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type III, as required to obtain finish color.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 1. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.
- C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- D. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

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- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
 7. Corrosion Inhibiting Admixture: ASTM C1582/C1582M.

2.6 STAINLESS STEEL CONNECTION MATERIALS

- A. Stainless Steel Bolts and Studs: ASTM F593, Alloy Group 1 or 2 studs.
1. Lubricate threaded parts of stainless steel bolts with an antiseize thread lubricant during assembly.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

2.8 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.
- B. Skate Stops: Provide surface mounted 1/4 inch thick by 2 inch wide Type 304 stainless steel skate stops in precast concrete benches at locations indicated on Drawings.
- C. Wood Bench Top: Provide manufacturer's standard flush mounted wood bench top at locations indicated in Drawings. Wood species shall be thermally modified ash.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions in hardened concrete to 0.06 percent by weight of concrete.
- D. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

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- E. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
 - G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117 to reach air content between 6 to 8 percent.
 - H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.

2.11 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose hardware items including anchors, dowels, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive

environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

- D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
- H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
 - 1. All units shall conform to shop drawings with a +/- 1/8-inch tolerance in dimension.
 - 2. All exposed edges shall have a minimum 1/8-inch radius to prevent chipping.

2.13 FINISHES

- A. Exposed faces to be free of joint marks, grain, and other obvious defects. Corners, including false joints to be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:

1. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 2. Integral Color: Provide integral color as selected by Architect from manufacturer's full range.
- B. Finish all exposed top and back surfaces of architectural precast concrete units to match face-surface finish. All exposed surfaces shall be factory sealed.
- C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.14 SOURCE QUALITY CONTROL

- A. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- B. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M and ACI 318. Take cores from unexposed surfaces.
- C. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- D. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

- B. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
- C. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.4 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet. Reseal all patched areas using sealer recommended by manufacturer.
- C. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 045000 – EXTERIOR MASONRY RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract and General Requirements, apply to the work specified in this section.

1.2 SUMMARY

- A. Section Includes:
 - 1. 100% raking and repointing of all mortar joints with custom pointing mix.
 - 2. Removal of damaged bricks and toothing in new and salvaged bricks.
 - 3. Through-wall and coping flashing.
 - 4. 100% cleaning of all exterior masonry surfaces.
 - 5. Severe soiling and algae growth cleaning.
- B. Related Requirements:
 - 1. Section 079200 – “Joint Sealants”

1.3 DEFINITIONS

- A. Hot Weather Stone Masonry Restoration: as used herein refers to work of this Section when temperature is above 100 deg F or when temperature is above 90 deg F and wind is above 8 mpg or when either of these conditions is predicted within 48 hours of use of mortar.
- B. Saturated, surface dry: Wet surfaces to receive mortar to ensure that surfaces are damp but free of standing water.
- C. Repointing: The process of raking out (removing) mortar and replacing it with new mortar.
- D. Low-Pressure Saturation Spray: 60 psi; 1-1/2 – 2 gpm per spray head.
- E. Low-Pressure Warm Water Wash: 100 to 400 psi; 4 – 6 gpm at 180 deg F.
- F. Medium-Pressure Warm Water Wash: 800 to 1200 psi; 4 – 6 gpm at 180 deg F.

1.4 QUALITY ASSURANCE

- A. Architect may randomly select areas of tuck-pointing to be raked for verification of the appropriate depth of pointing and void filling. Contractor shall bear the cost of repointing these areas of selected destructive testing in their base bid.
- B. Source of Materials: Obtain materials for masonry restoration from a single source for each type of material required to ensure match of quality, color, pattern, and texture.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Submit manufacturers' technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportion), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets.
 - a. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - b. For exposed brick, include test report for efflorescence according to ASTM C67.
 - 2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Quality Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising worker performance and preventing damage.
- C. Masonry Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used to for each phase of the masonry restoration work including protection of surrounding materials and Project site.
 - 1. Do not begin work on site until Architect has approved Masonry Treatment Program in writing. Photocopies of Contract Documents, excerpts from Contract Documents and/or duplication of text in Contract Documents will not be accepted for Work Description. Description for each type of restoration on each material shall include, but not be limited to:
 - a. Materials and Procedures: Materials, methods, tools, and equipment to be used for each phase and task of stone masonry restoration work.
 - 1) Include methods for keeping exposed mortar damp during curing period.
 - b. Protection: Description, including drawings, and diagrams, of proposed materials and methods of protection for preventing harm, damage, and deterioration caused by work of this Section to persons (whether involved in the Work or not); building elements, materials, and finishes, surrounding landscape and site, and the environment (including air and water).
 - 1) Include procedures for controlling noise and dust.
- D. Samples for Initial Selection: For the Following:
 - 1. Pointing Mortar: Submit sets of each type of mortar for pointing in the form of sample mortar strips, 6 inches long by ½ inch wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three samples of different mixes of colored sands and cements that produce a mortar matching the existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each sample was made.
 - 2. Brick, in the form of straps of five or more bricks.
 - 3. Stainless steel flashing, including drip edge and termination bar.
- E. Field Constructed Mock-Ups
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
3. Prior to start of general masonry restoration, prepare the following sample panels on the building where directed by the Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work. All costs associated with producing multiple samples shall be included in the base bid.
 - a. Cleaning: Demonstrate materials & methods to be used for each type of cleaning required, of masonry surface and condition of sample panels of approximately 25 sq. ft.
 - 1) Test adjacent non-masonry materials for possible reaction with cleaning materials.
 - 2) Allow waiting period of duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit study of sample panels for negative reactions.
 - b. Repointing: Prepare 3 separate sample areas of approximately 3'-0" high by 6'-0" wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other 2 for demonstrating quality of materials and workmanship expected in pointing mortar joints and for matching existing mortar joint color and texture.
 - c. Brick Removal and Rebuilding: Sample area up to 25 sq. ft. at location determined by Architect.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Photographs: Before commencement of restoration, Contractor shall take photographs of Project site and surrounding properties, including detailed documentation of the existing masonry conditions within the project scope. Refer to Quality Assurance Article above.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- D. Protect masonry restoration materials during storage and construction from wetting by rain, snow, or ground water, and from staining or intermixture with earth or other types of materials.
- E. Protect materials from deterioration by moisture and temperature. Store in a dry location or waterproof containers. 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.

1.8 FIELD CONDITIONS

A. General

1. Weather Requirements: Manufacturer's Recommendations: Perform work only when temperature of products being used, temperatures of existing and new materials and surfaces, and temperature and humidity of air at Project site comply with manufacturer's written instructions and specified requirements.
 - a. Clean masonry surfaces only when air temperatures are 40 deg. F and above and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.
 - b. Proprietary Mortars and Masonry Adhesives and Fillers: Perform work of this Section requiring proprietary patching materials and masonry adhesives and fillers only when surface and air temperatures are between 50 deg F and 85 deg F.
 - c. Hot-Weather Stone Masonry Restoration: Protect stone repair when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
 - 1) Protect fresh mortar from premature drying when temperature, humidity, and wind conditions result in rapid drying of mortar. Provide and maintain tarps against wind, direct sun, and rain for specified minimum periods.
 - d. Damage from Work in Cold or in Hot Weather: Remove work of this Section damaged by freezing during cold weather masonry work and/or damaged by premature or too-rapid drying during hot weather masonry work and replace with new masonry work complying with requirements of this Section at no additional cost to Owner.
 - e. Requirements of Referenced Standard: Perform work of this Section in compliance with the requirements and recommendations of Brick Industry Association Technical Notes 1, *Cold and Hot Weather Construction*, Latest Edition.
2. Conflicting Requirements: In each case in which there is a conflict between manufacturer's recommendations, recommendations of referenced standards, and other requirements specified in this Section, the most stringent and restrictive requirement shall govern.
3. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
4. Safety: Protect all persons, whether or not involved in work of this Section, from harm caused by or resulting from work of this Section.
 - a. Protection from Hazardous Materials: Protect workers and other persons from contact with hazardous materials resulting from work of this Section.
 - b. Protection from Noise: Limit noise generated by work of this Section to an absolute minimum. Prevent all persons, whether or not involved with the work of this Section, from noise that might adversely affect them.
5. Prevent mortar used in repointing repair work and injection grout from staining face of surrounding masonry and other surfaces. Remove immediately mortar in contact with exposed masonry and other surfaces.
6. Protect sills, ledges, and projections from mortar and sealant droppings.

1.9 SEQUENCING AND SCHEDULING

- A. Order pointing mortar immediately after approval of mockups. Take delivery of and store at project site a sufficient quantity to complete Project.

PART 2 - PRODUCTS**2.1 MATERIALS, GENERAL**

- A. Source limitations: Obtain each type of material for repairing and repointing masonry from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces unfinished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C216 and as follows:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide a custom blend of brick matching surrounding wall as manufactured by the following companies and approved by Architect prior to bidding. The exact blend of bricks shall be determined by creating mockups per the requirements listed in this section.
 - a. Acme Brick Company.
 - b. Glen-Gery Brick.
 - c. Belden Brick Company.
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
 - 3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 - 4. Size (Actual Dimensions): 3-5/8 inches wide by 2-3/8 inches high by 8 inches long.
 - a. Field verify existing brick dimensions to confirm sizes of required new bricks.
 - 5. Application: Use where brick is exposed unless otherwise indicated.
 - 6. Provide face brick matching color range, texture, and size of existing adjacent brickwork.

2.3 MORTAR GROUT AND MIXES

- A. General
 - 1. Mix mortars using proportions specified herein as adjusted, if necessary, by the amount of moisture in the ingredients. The proportions specified are for dry cements and limes and damp, loose (saturated, surface-dry) sand. If ingredients with different moisture contents are used (for example, lime putty is used in place of lime or dry sand is used in place of damp, loose sand), adjust quantities so that the proportions of ingredients in the mixes equal the proportions specified as approved by Architect.

2.4 MIXING OF MORTARS AND GROUTS

- A. Measuring: Measure mortar and grout ingredients carefully using containers with fixed volumes so that proportions are controlled and maintained throughout the work of this Section.
- B. Mixing Lime Mortars and Grouts: Mix lime mortars and grouts using a helical paddle mixer, a pan mixer (in which the mortar is mixed by rotating paddles), or a traditional roller mixer as approved by lime supplier and Architect.
- C. Water: Use minimum amount of water to produce a workable consistency for mortar's intended purpose.
 - 1. Mortar for Pointing: As dry a consistency as will produce a mortar sufficiently plastic to be worked into joints.
- D. After mixing, mortars for pointing or setting shall sit for 20 minute prior to use to allow for initial shrinkage. Mortar shall be placed in final position within two hours of mixing. Retempering of partially hardened material is not permitted.
- E. Mortar for grout shall be placed in final position within two hours of mixing or within period recommended by manufacturer of custom products, whichever is less. Retempering of partially hardened material is not permitted.
- F. Custom Patching Mortars and Grouts: Mix in accordance with manufacturer's written instructions.

2.5 PRE-MIXED SETTING MORTAR

- A. Portland Cement: ASTM C150/C150M, Type I or Type II; white or gray, where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C207, Type S
- C. Mortar Sand: ASTM C144 unless otherwise indicated.
 - 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - 2. Colored Mortar: Provide natural sand or other sound stone of color necessary to produce required mortar color.
 - 3. For exposed mortar, provide sand with rounded edges.
- D. Water: Potable

2.6 HISTORIC POINTING MORTAR

- A. A custom factory mixed Pointing Mortar to be formulated for tuck-pointing brick, which shall match existing mortar in color, texture, and mix.
 - 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. SpecMix; Tuckpointing Mortar.
 - b. Conproco; RePoint.
- B. Surface Preparation: Joints to receive pointing mortar must be sound and free of all dust, dirt, grease, laitance, and/or any other coating or foreign substance which may prevent proper adhesion. Remove all loose and deteriorated mortar. The minimum depth of mortar application is 1-1/2 times the width of the mortar joint or 1 inch, whichever is greater. Rinse joints with clean water.
- C. Mixing: The mixing ratio is approximately 4 to 5 parts replication mix to 1 part water by volume, depending on temperature and humidity. Place clean water in a clean, rust free mixing container and add the powder. Mix manually until the mortar is thoroughly mixed. The mortar shall be the consistency of damp sand. Follow manufacturer's recommendation.
 - 1. Add aggregate as required to match the color and texture of the existing mortar. Do not exceed the allowable ratio mix of aggregate to mortar per the manufacturer's requirements. Adding mineral pigments is not allowed for this project. Color and texture shall be adjusted using aggregates to the replication mix
- D. Pointing: Moisten the joint using clean water. If the surface is allowed to dry out before applying pointing mortar, this step must be repeated. The mortar shall be applied using appropriate pointing tools. Place the mortar into the joint so that it matches the original joint profile.
- E. Curing: Periodically mist mortar joints using clean water for at least a 72 hour period.
- F. Clean Up: Remove uncured mortar from the substrate before it dries using clean water and a rubber sponge. Cured mortar may only be removed chemically.
- G. Safety Requirements: It is recommended that safety goggles, gloves, and a dusk mask equipped with P-2 filters (or Equivalent) be worn for protection when mixing.
- H. Limitations:
 - 1. Never apply pointing mortar to a frosted or exceedingly hot substrate. The applied mortar must be protected from extreme heat, freezing, excessive wind, direct sunlight, and rain. Ambient temperature range shall be 40 deg. F to 90 deg. F with low to average humidity.
 - 2. Never add bonding agents to pointing mortar or use them as surface preparation materials.
 - 3. Minimum thickness of mortar application is 1" or 1-1/2 times the existing mortar width, whichever is greater.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 316, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.

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3. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - a. Solder metal items at corners
 - B. Flexible Flashing: Use one of the following unless otherwise indicated:
 1. Copper-Laminated Flashing: Provide metal flashing complying with ASTM B370. Use 5-oz./sq. f. for thru-wall flashing, copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Copper Sealtite 2000.
 - 2) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing NA.
 - 3) York Manufacturing, Inc.; Multi-Flash 500.
 - C. Application: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond wall face, use flexible flashing with a stainless steel drip edge.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use flexible flashing with a stainless steel drip edge.
 4. Where flashing is fully concealed, use flexible flashing.
 - D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard product or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
 - E. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.8 CLEANING MATERIALS AND EQUIPMENT

- A. Masonry Cleaner: Refer to PART 3 – EXECUTION for masonry cleaner products and solutions to be applied to stone and brick areas.
- B. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
- C. Brushes: Fiber bristle only.
- D. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume.
 1. For spray application of chemical cleaners, provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray-tip.
 2. For spray application of water, provide fan-shaped spray-tip which disperses water at angle of not less than 45 degrees.
- E. Mild Acidic Cleaner for Pointed Joints: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
 1. Products: Subject to compliance with requirements, provide basis of design:
 - a. Prosoco Vana Trol or approved equal.
 - b. All newly pointed joints shall be 100% cleaned.

2.9 ACCESSORY MATERIALS

- A. Masking Tape: Non-staining, non-absorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing work involved.
 - 2. Minimal possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave residue on surfaces.

2.10 TOOLS FOR JOINT PREPARATION

- A. Hand Tools for Joint Preparation: Chisels, hammers, and mallets.
 - 1. Thickness of Chisels: Maximum thickness of 5/8 times joint width extending from tip at least three times depth at which chisel will be inserted into joint;
 - a. Chisels for Use in Narrow Joints: Use custom ground thin carbide- tipped chisels for mortar removal from narrow joints.
 - 2. Brushes for Removing Dust and Dirt from Joints: Stiff, natural- or synthetic-fiber bristle brushes. No metal bristle brushes are acceptable.
 - 3. Pointing Trowels: Long, thin pointing trowels narrower than joints being pointed.
 - a. Custom fabricate special trowels for masonry pointing if necessary to ensure proper insertion and optimum compaction of mortar in thin joints.
 - 4. Special Tools: Provide special knives or special thin cutter blades for use in joints less than 1/8-inch wide.
- B. Small Power Tool:
 - 1. If successful use of the power tool is reviewed and approved by Architect, contractor may use the following tool for removal of the existing mortar joints:
 - a. The custom-made, 22-milimeter diameter, 1/8-inch thick, diamond tipped Dremel blades specially produce by Wagner Precision Rotary Instruments, LLC or approved equal.

PART 3 - EXECUTION**3.1 GENERAL PREPARATION**

- A. Comply with recommendations of manufacturers of chemical cleaners for protecting building surfaces against damage from exposure to their products.
- B. Examination: Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions have been corrected.

- C. Protection: Erect dust impervious barriers and take other measures necessary to prevent dust from traveling beyond work platform before using power grinders, or hand methods that generate airborne dust.

3.2 PROTECTION

- A. Protection: Erect dust impervious barriers and take other measures necessary to prevent dust from traveling beyond work platform before using power grinders, or hand methods that generate airborne dust.
- B. Protect persons, motor vehicles, surrounding surfaces of building whose masonry surfaces are being restored, building site, and surrounding buildings from injury resulting from masonry restoration work
 - 1. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings and other surfaces which could be injured by such contact.
 - 2. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 3. Dispose of run-off from cleaning operations by legal means and in manner which prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 - 4. Erect temporary protection covers over pedestrian walkways and at points of entrance and exit for persons and vehicles which must remain in operation during course of masonry restoration work.
- C. Protect glass and unpainted metal from contact with acidic chemical cleaners by covering them with protective film. Apply protective film to comply with manufacturer's recommendations.
- D. Protect unpainted metal from contact with alkali chemical cleaners by covering them with polyethylene protective film and waterproof masking tape.
- E. Containment of all run-off related to cleaning masonry will be a must in order to minimize impact on surrounding vegetation; contractor is responsible to meet all local, state and federal regulations in each masonry cleaner application, handling, and disposal.
- F. Prevent mortar from staining face of surrounding stone and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.3 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal

- penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. Install stainless steel drip edges with fabric flashing by interlocking hemmed edges to form hooked seam.
 - 3. Install all thru-wall and under coping flashings with positive slope to allow water to drain out, and avoid any ponding of water over flashings.
- C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
- 1. Space weep holes formed from wicking material 16 inches o.c.
 - 2. Trim wicking material flush with outside face of wall after mortar has set.

3.4 BRICK REMOVAL

- A. Carefully remove by hand at locations indicated any brick which are damaged, spalled, or deteriorated due to construction activities, including shoring and bracing of the existing building envelope. Cut out full units from joint to joint and in manner to permit replacement with full size units. Small hand power saw (3"-4" diameter) with 1/8" thick diamond blade only could be used for bed joints. Cut out head joints by hand with chisel and mallet only.
- B. Support and protect masonry indicated to remain which surround removal area.
- C. Salvage as many whole, undamaged bricks as possible.
- D. Remove mortar, loose particles, and soil from salvaged brick by cleaning with brushes and water. Store brick for reuse.
- E. Clean remaining brick at edges of removal areas by removing mortar, dust, and loose debris in preparation of rebuilding.
- F. Repair any damaged flashing to make watertight.

3.5 TOLERANCES

- A. Dimensions and Locations of Elements:
- 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
- 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch .
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.6 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in common bond matching existing brick; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches . Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Masonry: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Stainless Steel Corrugated Buck Anchor.
 - a. Basis-of-Design Product: Provide 345 Corrugated Buck Anchor, Stainless steel, 14 gauge or approved equal from:
 - 1) Wire-Bond
 - 2) Heckmann Building Products

3.8 JOINT PREPARATION FOR JOINTS CONTAINING MORTAR

- A. General: Remove mortar from joints to a depth of 1 inch, 1-1/2 times the width of the joint, or to sound mortar, whichever is deepest. In all cases remove deteriorated, weathered, and loose material to sound mortar.
- B. Completely remove mortar from surfaces of masonry units adjoining joint to allow new mortar to bond directly with masonry units.
- C. Cut surface of mortar at rear of joint at a uniform depth from and parallel to wall surface.
- D. Do not damage faces or arises of masonry units during joint preparation. Cease joint preparation work if, in Architect's judgment, masonry units are damaged by methods being used to prepare joints. Do not resume work until tools, workers, and methodology have been corrected to ensure that masonry units are not damaged and that work meets standard set by approved mock-up.
- E. Mortar Removal Using Hand Tools: Use hand tools for removal of mortar from head joints in brickwork, from other joints in stone and brick masonry that are less than 6 inches long, and from other joints in which use of power tools might damage masonry units. Use hand tools to complete mortar removal from joints where power tools have been used to partially remove mortar.
- F. For narrow joints of 1/8-inch or less in width, rake mortar from joints manually with a sharp knife blade or cutter made for this purpose. Cutter may be used with or without aid of a hammer.
- G. Sharpen chisels as often as necessary to provide for optimum cutting of mortar and to minimize chipping but at least hourly.
- H. Cleaning: Remove loose mortar and foreign material from raked joints using a fine, stiff natural- or synthetic-fiber bristle brush. Remove remaining particles, dust, and dirt using clean, filtered, oil-free compressed air. Ensure that dust and dirt are not blown back into previously cleaned joints.

3.9 MORTAR APPLICATION

- A. Wetting: Thoroughly drench masonry with water 24 hours prior to pointing joints. Thoroughly wet masonry again immediately before pointing joints and allow surfaces to dry slightly. At time of masonry pointing, surfaces shall be damp, so that they do not rapidly absorb moisture, but free of standing water (saturated, surface dry).
1. Failure to Properly Wet Substrate: Evidence that masonry to be pointed has not been properly dampened to prevent water in the mortar from being too rapidly absorbed by the masonry will be cause for Architect to reject pointing work. Remove rejected pointing, properly prepare joints for pointing, and provide new mortar to meet requirements of this Section at no additional cost to Owner.
- B. Masonry Pointing: Point joints as follows:
1. Using a long, thin masonry pointing trowel, apply pointing mortar to a dampened surface, packing the mortar into the joint to ensure full depth compaction. The mortar should be brought flush with the face of the masonry unit, and left to set for final tooling. Pointing mortar can be applied in a single lift regardless of the depth. Successive lifts with waiting periods between lifts are not necessary.
 2. Do not spread mortar over edges onto exposed surfaces of masonry units. Do not featheredge mortar.
 3. When stopping work at end of each day or for other reasons, stagger layers of mortar so that there will be no through joints in mortar inserted into joints. Stagger joints in layers so that they are at least 3 inches from each other.
 4. Where applying new work to that of a prior day, dampen previous work to ensure good bond.

3.10 JOINT TOOLING

- A. Profile: After mortar joint has “set”, tool joints to profile to match original joint profiles as directed by Architect. Solidly compress mortar so that it adheres well to masonry on both sides and forms a dense surface. Premature or late tooling will result in unacceptable finishes, which will be rejected.

3.11 CURING

- A. Keep newly pointed joints damp for at least 72 hours after mortar has been inserted. Do not apply a direct stream of water to joints for at least 7 days after mortar has been placed.
- B. Ensure masonry temperature remains as required by specifications until mortar is thoroughly cured.

3.12 CLEANING AND REPAIR OF MORTAR JOINTS

- A. Water Washing: Wash pointed masonry with clean filtered water, mild acidic cleaner, and nonabrasive hand tools to remove mortar debris from masonry surfaces. Do not use chemical cleaners.
1. Wash within 72 hours after completion of masonry pointing.
 2. Use blunt-edged wood scrapers, soft natural bristle brushes, and rough towels along with water to remove mortar debris. Do not use wire brushes. Do not scratch joint surfaces.

3. Do not allow pointing mortar beyond the face of the masonry unit. All edges of masonry shall remain visible.

- B. Repair of Pointed Joints: As cleaning progresses, examine joints to locate cracks, holes, and other defects. Carefully point up and fill such defects with mortar. Where joints are defective in opinion of Architect cut out joints to minimum depth of 1 inch, or two-and-one-half times joint width, whichever is greater; properly prepare joint substrates; and provide new pointing mortar exercising extreme care to ensure that color matches that of adjacent masonry pointing work. Exposed joint surfaces shall be free from protruding mortar, holes, pits, depressions, and other defects.

3.13 CORRECTIVE MEASURES

- A. Correcting Unacceptable Joints: Should a crack occur in any joint surface, should mortar separate from a masonry unit, indicating that it did not form a strong mechanical and chemical bond with the unit, or should Architect determine that for another reason masonry pointing work does not equal or exceed the minimum standard established by the approved mock-up, remove mortar to a minimum depth of 1 inch, properly prepare joint substrates, and repoint following requirements of this Section to Architect's satisfaction at no additional cost. At completion of work of this Section, joints shall be full of mortar soundly adhered to surfaces of masonry units at sides of joints and without defects.

3.14 INSTALLATION OF JOINT SEALANTS

- A. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1 inch. Rake joints to uniform depths with square bottoms and clean sides. Rub masonry sand to fresh sealant joint to simulate adjacent mortar joint appearance.
- B. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants".
- C. Remove excess sealant and smears as sealant is installed.

3.15 BRICK CLEANING

- A. This method shall be used on all brick surfaces.
- B. Pre-wet the masonry surface with clean water.
- C. Mix one part clean water with one part 800 Stain Remover.
- D. Apply the mix directly to the masonry surface with recommended masonry brush or low-pressure spray. Pressure spray above 50 psi drives the chemicals deep into the surface, making complete rinse difficult.
- E. Let the cleaner stay on the surface for 3-5 minutes. Gently scrub with a non-metallic, short-fibered scrub brush to loosen the stains or until stains are gone. If treated surfaces are left unattended, keep people away from cleaner. Don't let the

cleaner dry on the surface. If the cleaner begins to dry in less than 5 minutes, water rinse and reapply cleaner.

- F. Reapply cleaner and rinse with fresh water. Thorough rinsing gets all residues off the surface. The best combination of rinsing pressure and water volume is provided by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 40 degree fan spray tip. Equipment should be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of more sensitive surfaces. Avoid multiple applications.
- G. Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use manufacturer's application instructions. Let the test panel dry 3 to 7 days before inspection. Keep test panels available for comparison throughout the cleaning project.

3.16 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent non-stone surfaces. Use detergent and soft brushes or cloths.
- C. Remove masking materials, leaving no residues that could trap dirt.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

END OF SECTION 045000

SECTION 055000 - DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Landscape planter walls and benches
 - 2. Tree grates.

1.2 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative metal.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples for Verification: For each type of exposed finish.
 - 1. Submit finished Samples showing metal color, and quality of finish.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop

Drawings.

- B. Planter walls require adequate structural support. Unless noted otherwise, surface on which planter walls are to be mounted shall be smooth and level. Planter walls shall have continuous base support and are required to be anchored to concrete base at all provided mounting points.

1.7 WARRANTY

- A. Special Warranty: **Manufacturer** agrees to repair or replace components of steel planter walls and associated benches that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Deterioration of metals and other materials beyond normal weathering.
- B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.2 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless Steel Items: Type 304 stainless steel fasteners.
 - 2. Uncoated-Steel Items: Type 304 stainless steel fasteners.
 - 3. Dissimilar Metals: Type 304 stainless steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.
 - 1. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.3 LANDSCAPE PLANTER WALLS

- A. Weathering Steel Planter Walls: ASTM A606-4, 12 gauge minimum sheet, brake formed and welded. Wall reinforcement elements of same material shall be provided as required to meet structural requirements.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide Tournesol Siteworks; Kitsap Planter Walls or equivalent product as approved by Architect.
 2. Construction: Anchored planter walls to be brake formed and fully welded at vertical and horizontal seams. 1-1/2 inch deep top lips are to be brake formed or fully seam welded.
 3. Performance Characteristics: As confirmed by Finite Element Analysis, vertical walls will not deflect more than L/300 over the length of each wall section when loaded with 95 lbs. / cu. Ft. level backfill soil media to within 2 inches of top of wall. Manufacturer to provide copies of analysis with shop drawings.
 4. Finish: Mill finish.
 5. Sizes: Custom as indicated on Drawings.
 6. Anchors: 3/8-inch stainless steel expansion or epoxy anchors at spacing required to meet performance characteristics.
 7. Accessories:
 - a. Pocket for fully recessed electrical receptacle at locations shown on Drawings.
- B. Planter Wall Benches: Thermally modified wood benches designed to integrate with planter walls.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide Tournesol Siteworks; Wally Bench Type 'A' or equivalent product as approved by Architect.
 2. Construction:
 - a. Lumber: 1 inch by 3-1/2 inch thermally modified oak planks. 1/8-inch radius on all corners and edges.
 - b. Steel Support Arms: Powder coated carbon steel cantilevered support arms with powder coated steel board straps. Ease all steel edges prior to finishing.
 3. Size: Standard bench depth is 18 inches. Length shall be custom as shown on Drawings. Provide corner pieces as required.
 4. Powdercoat Finish: Black.
 5. Accessories: Provide internal support brackets intended to be used to mount through metal planter walls and into concrete slab as required by manufacturer.

2.4 TREE GRATES

- A. Tree Grates: Manufacturer's **custom designed** tree grates and frames.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide Streetlife; Tree Grille Strips or equivalent manufacturer as approved by Architect.
 2. Grates: Weathering steel (corten).
 3. Frames: Weathering steel (corten).
- B. Shape and Size: As indicated on Drawings
- C. Finish: As fabricated.

- D. Pattern: Willow.

2.5 ABRASIVE METAL NOSINGS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide Wooster Products; 630A Supergrit or equivalent product as approved by Architect.
 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
 3. Nosings:
 - a. Square-back units, 3 inches wide, for casting into concrete steps.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply clear lacquer to concealed surfaces of extruded units.

2.6 MISCELLANEOUS MATERIALS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.
- B. Sealant: Refer to Section 079200 "Joint Sealants".

2.7 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly.
1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
 3. Use connections that maintain structural value of joined pieces.
- B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- F. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- G. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- H. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
 - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.9 STEEL AND IRON FINISHES

- A. Weathering Steel: Mill finish.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2605 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- G. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.3 INSTALLATION OF TREE GRATES

- A. Tree Grates: Install according to manufacturer's written instructions. Set grate segments flush with adjoining surfaces. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- minimum growth radius around base of tree; break away portions of casting, if necessary, according to manufacturer's written instructions.

3.4 INSTALLATION OF PLANTER WALLS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Fitting and Placement: Test fit planter walls in place and bolt together finger tight to confirm installation location. Drill anchor holes into concrete footings per anchor manufacturer specifications.
- C. Apply waterproof sealant to the outside of each mating surface before being placed.
- D. Place each section, bolt to adjacent section and install anchors into concrete footings. After each section is aligned, fully tighten each anchor and seam connection.
- E. Install integrated planter wall benches by drilling through planter walls using provided templates and applying sealant between mounting bracket and planter wall.

- F. Apply drainage mat to the inside surface of all walls.

3.5 INSTALLATION OF NOSINGS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.6 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055000

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed decorative metal railings.
2. Stainless steel decorative railings, with illuminated rail.
3. Steel and iron decorative railings.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor and exterior deck areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Metal railings assembled from standard components.
2. Glass products.
3. Glazing cement and accessories for structural glass railings.
4. Fasteners.
5. Bituminous paint.
6. Nonshrink, nonmetallic grout.
7. Anchoring cement.
8. Handrail brackets.

- B. Shop Drawings: Include plans, elevations, sections, and attachment details.

1. For illuminated railings, include wiring diagrams and roughing-in details.

- C. Samples for Verification: For each type of exposed finish required.

1. Each type of glass and glass edge required.

- D. Delegated Design Submittal: For installed products indicated to comply with performance

requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.
- B. Product Test Reports: For tests performed by a qualified testing agency, in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.
- C. Welding certificates.
- D. Evaluation Reports: From ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 - 1. For glazed decorative metal railings.
 - 2. For post-installed anchors.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Glazed decorative metal railing manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Missouri to design glazed decorative metal railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65, or minimum ultimate tensile strength divided by 1.95.
 - 2. Stainless Steel: 60 percent of minimum yield strength.
 - 3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA CW-12, "Structural Properties of Glass."
- C. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Structural Glass Railings and Glass-Infill Panels:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with the IBC and ASTM E1300:
 - 1. Wind Load: As indicated on Drawings.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 GLAZED DECORATIVE METAL RAILINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - 2. Julius Blum & Co., Inc.
 - 3. Livers Bronze Co.
 - 4. Wagner Companies (The); R&B Wagner, Inc.

- B. Source Limitations for Laminated Glass: Obtain from single source from single manufacturer.
- C. Product Options: Information on Drawings and in the Specifications establishes requirements for railing system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Extruded Bars and Shapes, Including Extruded Tube: ASTM B221, Alloy 6063-T5/T52.
- C. Plate and Sheet: ASTM B209, Alloy 6061-T6.
- D. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
- E. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

- A. Sheet, Strip, Plate, and Flat Bar: ASTM A666 or ASTM A240/A240M, Type 304.
- B. Bars and Shapes: ASTM A276, Type 304.

2.6 STAINLESS STEEL RAILINGS

- A. Source Limitations: Obtain stainless steel decorative railing components from single source from single manufacturer.
- B. Tubing: ASTM A554, Grade MT 304.
- C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.
- D. Flat Bar: ASTM A666, Type 304.

-
- E. Bars and Shapes: ASTM A276/A276M, Type 304.
 - F. Illuminated Hand Rails: Provide internal illumination using concealed, internally wired, integrated LED lamps to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service.
 - 1. LED Luminaires: Comply with Section 265000 "Lighting".

2.7 STEEL RAILINGS

- A. Source Limitations: Obtain steel decorative railing components from single source from single manufacturer.
- B. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- C. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.8 GLASS AND GLAZING PRODUCTS, GENERAL

- A. Glazing Publications: Comply with written instructions of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA/GANA Publications: "GANA Laminated Glazing Reference Manual" and "GANA Glazing Manual."
- B. Safety Glazing: Glazing is to comply with 16 CFR 1201, Category II.
- C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label is to indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- E. Low-Iron Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- F. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Class 1 and low-iron clear, or Class 2 (tinted) as indicated, Quality-Q3.
- G. Glazing Cement and Accessories for Structural Glass Railings: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.

- H. Sealant and Accessories for Structural Glass Railings: Sealant, gaskets, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.

2.9 GLASS HANDRAILS AND GUARDS

- A. Laminated Glass Handrails and Guards: ASTM C1172, Type II with two plies of glass bonded together by an interlayer.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: 0.030 inch.
 - 3. Kind: LT (laminated tempered).
 - 4. Glass Color: Inner-ply low-iron clear; outer-ply low-iron clear.
 - 5. Interlayer Color: Clear.
 - 6. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than 6.0 mm thick each.

2.10 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Aluminum Components: Type 304 stainless steel fasteners.
 - 2. Stainless Steel Components: Type 304 stainless steel fasteners.
 - 3. Hot-Dip Galvanized-Steel Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 4. Dissimilar Metals: Type 304 stainless steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
 - 1. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts; ASTM F594.

2.11 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

- B. Handrail Brackets: Cast stainless, center of handrail 2-1/2 inches from face of wall.
 - 1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Anchoring Cement: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.12 FABRICATION OF GLASS PANELS AND BALUSTERS

- A. Fabricate glass to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
- B. Structural Glass Balusters: Provide laminated, tempered structural glass balusters.
 - 1. Edge Finish: Grind smooth and flat polish exposed edges of glass, including those at open joints, to produce smooth, square edges with glass edge finishes.
 - 2. Fabricate structural glass balusters to maintain equal length glass widths and uniform spacing of 1/2 inch between glass balusters.

2.13 FABRICATION OF METAL RAILS

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.

- E. Fabricate connections that will be exposed to weather in a manner to exclude water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.
- I. Form changes in direction as follows:
 - 1. By bending to smallest radius that will not result in distortion of railing member.
- J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.

2.14 METAL FINISH REQUIREMENTS, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.15 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Sheet, Strip, Plate, and Bar Finishes:
 - 1. Directional Satin Finish: ASTM A480/A480M, No. 4.
- D. Stainless Steel Tubing Finishes:
 - 1. 180-Grit Polished Finish: Uniform, directionally textured finish.

2.16 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows:
 - 1. Comply with SSPC-SP 16.
- D. Painted Finish: Comply with Section 099600 "High Performance Coatings."
 - 1. Color: As indicated in Color Schedule.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.
- B. Perform cutting, drilling, and fitting required for installing metal railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of metal railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 INSTALLATION OF GLASS BALUSTERS

- A. Structural Glass Railings:
 - 1. Install assembly to comply with railing manufacturer's written instructions.
 - 2. For field-assembled balusters, attach base channel to building structure, insert glass in base channel, and bond with glazing cement.
 - a. Support glass balusters in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement.
 - b. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 3. Adjust spacing of glass balusters so gaps between balusters are equal before securing in position.
 - 4. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.3 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.4 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.5 ANCHORING POSTS

A. Anchor posts with flanges as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless steel railings, weld flanges to posts and bolt to concrete slab as indicated in Drawings.
2. For steel railings, weld flanges to posts and bolt to concrete slab as indicated in Drawings.

3.6 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.7 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Self -adhering modified bituminous sheet waterproofing system, including protection course and drainage panels, for vertical below-grade applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Pre-Installation Conference: Conduct conference at Project site. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - a. Warranty Period: Five years from date of Substantial Completion.
- B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS**2.1 WATERPROOFING SYSTEM**

- A. Provide complete waterproofing system in accordance with waterproofing Manufacturer's written recommendations and requirements for warranty.
- B. Source Limitations: Provide waterproofing system components from single source from single manufacturer. Provide accessory products including drainage panel and protection course from sources as recommended in writing by waterproofing manufacturer.
- C. Material Compatibility: Waterproofing materials shall be compatible with one another and with adjacent work under conditions of service and application required, and as demonstrated by waterproofing manufacturer based on testing and field experience.
- D. Performance Requirements: Installed waterproofing system shall withstand thermally induced movement and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Waterproofing system shall remain watertight.

2.2 MODIFIED BITUMINOUS SHEET MEMBRANE WATERPROOFING

- A. Modified Bituminous Sheet Membrane: 60-mil (1.5 mm thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene-film reinforcement, with

release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products and Manufacturers
 - a. CCW Miradri 860/861 by Carlisle Coatings and Waterproofing.
 - b. Bituthane 3000 by Grace Construction Products.
 - c. Blueskin WP 200 by Henry Company.
 - d. 650 Membrane by Polyguard Products, Inc..
 - e. Sealtight MEL-ROL by W. R. Meadows.
 2. Physical Properties:
 - a. Membrane Tensile Strength; ASTM D 412, Die C, modified: 250 psi minimum.
 - b. Ultimate Elongation; ASTM D 412, Die C, modified: 300 percent minimum.
 - c. Low-Temperature Flexibility; ASTM D 1970, at minus 20 deg F: Pass.
 - d. Crack Cycling; ASTM C 836, after 100 cycles of 1/8-inch movement: Unaffected.
 - e. Puncture Resistance; ASTM E 154: 40 lbf minimum.
 - f. Water Absorption; ASTM D 570, after 48-hour immersion at 70 deg F: 0.2 percent weight-gain maximum.
 - g. Water Vapor Permeance; ASTM E 96, Water Method: 0.05 perms maximum.
 - h. Hydrostatic-Head Resistance; ASTM D 5385: 200 feet, minimum.
- B. Concealed Strip Flashing: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
1. Furnish liquid-type auxiliary materials complying with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or VOC compliant solvent borne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- G. Metal Termination Bars: Stainless steel bars, approximately 1 by 1/8 inch thick, predrilled at 9-inchcenters.

2.4 PROTECTION COURSE

- A. Protection Course: Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
1. Thickness: 1/4 inch, nominal, for vertical applications
 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 40 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 18 gpm per ft.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive vertical waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps for vertical applications only. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
 - 1. Orientation: Starting from bottom of wall, install sheeting in horizontal application with lapped edges over the top edge of the lower sheet while working up the wall.
- E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- F. Termination Bars: Securely fasten top and bottom termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.
 - 1. Install termination bar at location indicated on drawings.
 - 2. Apply compatible sealant at top edge of termination bar. Refer to section 079200 - Joint Protection.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.

- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION BOARD, DRAINAGE PANELS AND INSULATION INSTALLATION

- A. Protection Course: Install protection course with butted joints before installing drainage panels.
- B. Drainage Panel: Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Ensure that drainage channels are aligned and free of obstructions. Protect installed molded-sheet drainage panels during subsequent construction.

3.5 FIELD QUALITY CONTROL

- A. Water Tests at Horizontal Surfaces: On completion of installation of membrane, dam areas in preparation for flood testing. If entire area is too large to test at one time, divide into smaller pieces.
- B. Flood area to a depth of not less than 3 inches with clean water. After not less than 24 hours, check for leaks.
- C. If leaking is found, patch using same waterproofing materials; repeat flood test.
- D. When the area is proved watertight, drain the water and remove dam.

3.6 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Ten years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.

- b. Master Builders; Master Seal NP100.
- c. Pecora Corporation; 895NST.
- d. Tremco Incorporated; Spectrem 3.

2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bi-cellular polyethylene foam backer rod), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

-
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - a. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½ inch deep or less than ¼ inch deep.
 - b. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% - 125% of joint width.
- F. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Clean the adjoining surfaces by whatever means necessary to eliminate evidence of spillage.
- G. Do not overheat hot-applied sealants.
- H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints in vertical concrete surfaces.

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- c. Joints between different materials listed above.
 - d. Other exterior joints as indicated on Drawings.
- 2. Joint Sealant: Silicone, Non-Staining, S, NS, 50, NT.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Galvanized metal.

1.3 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 1 small kit of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each paint product from single source from single manufacturer.
- B. Provide products indicated in the High-Performance Coating Schedules at the end of Part 3 this section.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. Exterior Exposure: SSPC-SP 6 Commercial Blast Cleaning.
 - a. If conditions will not permit commercial blast cleaning, then prepare exterior steel substrates with SSPC-SP 3 Power Tool Cleaning with a minimum of a 1.0 mil angular surface profile. Confirm with Architect that this method is acceptable in lieu of commercial blast cleaning prior to cleaning substrates.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - 1. Remove any streaking and patch and blend scratches and chips in shop-applied primer.
- F. Galvanized-Metal Substrates: Remove any existing coatings, grease and oil residue from galvanized metal by any means feasible. Prepare substrate in accordance with SSPC-SP 16 with a minimum angular profile of 1.5 mils. A test patch shall be provided to ensure proper adhesion to the substrate.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in coating schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturer.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Thermoset Fluoropolymer Coating System:
 - a. Primer: modified aromatic polyurethane primer.
 - 1) Tnemec; Series 1 Omnithane. Applied at 2.5-3.5 mils DFT.
 - b. Intermediate Coat: Aliphatic acrylic polyurethane. Low VOC.
 - 1) Tnemec; Series 1095 Endura-Shield. Applied at 2.0-3.0 mils DFT.
 - c. Topcoat: Exterior, Thermoset Fluoropolymer, Pigmented, Gloss.
 - 1) Tnemec; Series 1070 Fluouronar. Applied at 2.0-3.0 mils DFT.
- B. Galvanized-Metal Substrates:
 - 1. Thermoset Fluoropolymer Coating System:
 - a. Primer: Polyamidoamine epoxy primer.
 - 1) Tnemec; Series N69 Hi-Build Epoxoline II. Applied at 2.0-3.0 mils DFT.
 - b. Topcoat: Exterior, Thermoset Fluoropolymer, Pigmented, Gloss.
 - 1) Tnemec; Series 1070 Fluouronar. Applied at 2.0-3.0 mils DFT.

END OF SECTION 099600

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Swing Bench Seating.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts in concrete footings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For factory-applied finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SWING BENCH SEATING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Plenitude Urban Swing by Morelli.
- B. Structural Frame: Painted Steel.
- C. Bench and Back:
 - 1. Material:
 - a. Bench Frame: Painted Steel.
 - b. Bench Seat and Back: Recycled plastic planks, evenly spaced, parallel.

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2. Seat Height: 17.5 inches.
3. Overall Height: 76.5 inches.
4. Overall Width: 92.5 inches.
5. Overall Depth: 22.5 inches.
6. Arms: Two, one at each end.

a. Arm Material: Match frame & seat.

7. Weight: 161 lbs.

D. Steel Finish: Galvanized and color coated.

1. Color: As selected by Architect from manufacturer's full range.

E. Recycled Plastic Bench Color: As selected by Architect from manufacturer's full range.

2.2 HAMMOCK STAND

A. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Hammock Stand by Custom Mfg. & Polishing, Inc, Springfield, MO.

B. Hammock Base:

1. Material: 1/2-inch carbon steel.
2. Shape: Elliptical.
3. Length: 26 inches.
4. Width: 12 inches.
5. Anchor Holes: 6 total anchor holes, 7/8-inch diameter.

C. Hammock Stand:

1. Material: 3/8-inch carbon steel
2. Overall Height: 72 inches.
3. Cutouts: "hammock" wording cut out of material.
4. Cutouts: Custom stacked MU logo
5. Cutouts: Organic shapes for anchoring hammocks.

D. Steel Finish: Powder coated.

1. Color: As selected by Architect from manufacturer's full range.

E. Concrete Base Forms: Provide 12-ga. carbon steel concrete forms.

2.3 MATERIALS

A. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with

- ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.

- B. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

1. Polyethylene: Fabricated from virgin plastic HDPE resin.

- C. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality..

- D. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.

- E. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

2.4 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

- D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

- E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.5 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 129300

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 PERFORMANCE REQUIREMENTS

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

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.**

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications:** Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications:** Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

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

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 FASTENER SYSTEMS

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

2.4 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION**3.1 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.

-
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
 - L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

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

3.4 ADJUSTING

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

3.5 PAINTING

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

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

-
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
 - D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
 - E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
 - F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
 - G. Use padded hangers for piping that is subject to scratching.
 - H. Use thermal-hanger shield inserts for insulated piping and tubing.
 - I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
 - K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Seton Identification Products.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 3/4 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content:** Include equipment's Drawing designation or unique equipment number.

- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Brady Corporation.
 - 2. Brimar Industries, Inc.
 - 3. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 3/4 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Brady Corporation.
 - 2. Brimar Industries, Inc.
 - 3. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 3/4 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping
 - a. Background: Blue
 - b. Letter Colors: White.

END OF SECTION 22 0553

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

2.5 SECUREMENTS

A. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. C & F Wire.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Just Manufacturing.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

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

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- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
 - L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
 - M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
 - N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
 - O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

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4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of

flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

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

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold: Insulation shall be the following:
 - 1. Flexible Elastomeric:
 - a. Pipe less than 1.5" shall be 0.5 inch thick.
 - b. Pipe 1.5" and larger shall be 1 inch thick.

END OF SECTION 22 0719

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS**A. Pipe-Flange Gasket Materials:**

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.**C. Solder Filler Metals: ASTM B 32, lead-free alloys.****D. Flux: ASTM B 813, water flushable.****E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.****F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.****2.4 TRANSITION FITTINGS****A. General Requirements:**

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.**2.5 DIELECTRIC FITTINGS****A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.****B. Dielectric Nipples (Waterways):**

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Elster Perfection Corporation.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Victaulic Company.
- 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 - 5. End Connections: Male threaded or grooved.
 - 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install domestic water piping level without pitch and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.

- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 4 and Smaller: Use dielectric nipples.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING**A. Perform the following adjustments before operation:**

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

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

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.**C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.**

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping,, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION 22 1116

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Nonmetallic-sheathed cable is not permitted.
- C. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- D. Health care rated metal-clad cable is permitted only as follows:
 1. Where concealed above accessible ceilings for final connections from junction boxes to luminaires
 - a. Maximum Length: 5 feet.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.

- C. Comply with NEMA WC 70
- D. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83
- E. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL-44
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- G. Conductor Material
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project.
 - 2. Copper Conductors: Soft drawn annealed, 98% conductivity, uncoated copper conductors complying with ASTM B 3, ASTM B 8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33
- H. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code
 - a. 208Y/120V, 3 phase, 4 Wire System:
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Phase C: Blue
 - 4) Neutral/Grounded: White
 - b. Equipment Ground, All systems: Green

2.3 COPPER BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. American Bare Conductor.
 - 2. Southwire Company.
 - 3. WESCO.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN/THWN or Type THHN/THWN-2: Comply with UL 83.

2. Insulation voltage rating: 600 V

2.4 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. American Bare Conductor.
 2. Southwire Company.
 3. WESCO.
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. RoHS compliant.
 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 1. Single circuit.
 2. MC may be used for lighting fixture whips up to 6 feet long, one per fixture, not daisy-chained.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Minimum Conductor size is #12 AWG
- H. Conductor Insulation:
 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 2. Type XHHW-2: Comply with UL 44.
- I. Minimum insulation rating is 90°C
- J. Armor: Steel, interlocked.
- K. Jacket: PVC applied over armor.

2.5 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. 3M Electrical Products.
 - 2. ABB (Electrification Products Division).
 - 3. Hubbell Incorporated (Hubbell Power Systems).
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION**3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

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- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
 - C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
 - E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
 - F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

- A. Product Data: For steel slotted support systems.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS**2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Thomas & Betts Corporation, A Member of the ABB Group.
 - 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) Simpson Strong-Tie Co., Inc.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

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

END OF SECTION

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Thomas & Betts Corporation; A Member of the ABB Group.

- c. Wheatland Tube Company.
 - 2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. GRC: Comply with ANSI C80.1 and UL 6.
 - 4. EMT: Comply with ANSI C80.3 and UL 797.
 - 5. FMC: Comply with UL 1; zinc-coated steel.
 - 6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Thomas & Betts Corporation; A Member of the ABB Group.
 - c. Wheatland Tube Company.
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 - 6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Nonmetallic Conduit: Shall not be used.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- 1. B-line, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Square D.

- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Hoffman; a brand of Pentair Equipment Protection.
 - 2. RACO; Hubbell.
 - 3. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Shall not be used.
- F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- L. Gangable boxes are allowed.

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- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
1. NEMA 250, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.

- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:

-
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- L. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Conduit extending from interior to exterior of building.
 4. Conduit extending into pressurized duct and equipment.
 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 6. Where otherwise required by NFPA 70.
- T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for whips from junction boxes to single light fixtures.

-
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- X. Locate boxes so that cover or plate will not span different building finishes.
- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for conductor and communication- and control- cable.
2. Warning labels and signs.
3. Equipment identification labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Baked-Enamel Warning Signs:
1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches.
- C. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Permanent Engraved nameplate
1. Nameplates shall be engraved three-layer Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 1. Power.
 2. UPS.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Indoor Equipment: Laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- b. Outdoor Equipment: Laminated acrylic or melamine label 4 inches high.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

- a. Panelboards, electrical cabinets, and enclosures.
- b. Electrical switchgear and switchboards.
- c. Disconnect switches.
- d. Enclosed circuit breakers.
- e. Contactors.

3.3 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 1. Color shall be factory applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Toggle switches, 120/277 V, 20 A.
 - 4. Wall plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Essential Electrical System: Red.
 - 3. SPD Devices: Blue.

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4. Isolated-Ground Receptacles: Orange.

F. Wall Plate Color: For plastic covers, match device color.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hubbell Incorporated (Wiring Device-Kellems).
2. Legrand North America, LLC (Pass & Seymour).
3. Leviton Manufacturing Co., Inc.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole, Two-Pole, Three-Way, and Four-Way Switches, 120/277 V, 20 A:

1. Standards: Comply with UL 20 and FS W-S-896.

2.5 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Device Installation:
 - 1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 5000 - LED LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:

1. Solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.2 ACTION SUBMITTALS

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

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

- B. Product Certificates: For each type of luminaire.

- C. Product test reports.

- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F.
 - 1. Relative Humidity: Zero to 95 percent.
- B. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

- A. 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.
- B. 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.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Columbia Lighting; Hubbell Lighting Incorporated.
 - 2. Eaton (Lighting).
 - 3. H. E. Williams, Inc.

4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. Cooper Lighting

D. Nominal Operating Voltage: 120 V ac.

E. Lamp:

1. Lumens (lm): No less than 95 percent and no more than 110 percent of lm scheduled for basis of design fixture.
2. Efficacy (lm/W): No less than 95 percent of lm/W scheduled for basis of design fixture.
3. Color rendering index (CRI): No less than scheduled for basis of design fixture.
4. Correlated color temperature (CCT): 3500 K.
5. Rated lamp life of 50,000 hours to L70.
6. Dimmable from 100 percent to 0 percent of maximum light output.
7. Internal driver.

F. Recessed luminaires shall comply with NEMA LE 4.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.4 METAL FINISHES

A. 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.

2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- C. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. 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.
- D. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 5000

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demotion and removal of above- and below-grade site improvements outside courtyard area.
2. Protecting existing vegetation to remain.
3. Removing existing vegetation.
4. Clearing and grubbing.
5. Stripping and stockpiling topsoil.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion and sedimentation control.

1.2 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by Owner.
- C. Utility Locator Service: Notify Missouri One Call for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control and tree protection measures are in place.
- E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain as shown on the Plans. Contractor shall verify all Superintendents, Managers, Subcontractors, etc., are aware of and understand where vegetation is to be protected.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

3.4 EXISTING UTILITIES

- A. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than 5 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Remove all stumps by excavating to include removal of associated root system.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 to 18 inches, as encountered onsite, in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations in onsite area shown on Plans without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within the area under the dripline of trees indicated to remain.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - 4. Stockpile surplus topsoil to allow for respreading deeper topsoil. Dispose of excess soil per Owner.
- D. Within landscaped areas/planter boxes inside courtyard, remove full depth of topsoil and dispose of offsite.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

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2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning tree, shrub, and other vegetation waste is not permitted.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for pavements, turf and grasses, and plants.
3. Subbase course for concrete pavements.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for demolition and removal of selected portions of courtyard and courtyard walls.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, will be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock:

1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cu. yd. (0.57 cu. m) in volume.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.**I. Subbase Course:** Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.**J. Subgrade:** Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.**K. Utilities:** On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.**1.3 SUBMITTALS****A. Material Test Reports:** For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698.

B. Preexcavation Photographs or Video Recordings: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.**1.4 FIELD CONDITIONS****A. Traffic:** Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Missouri One Call for area where Project is located before beginning earth-moving operations.**C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.****D. The following practices are prohibited within the areas under the dripline of trees to remain:**

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
8. Exposure to exhaust gases, heat sources, flames, ignition sources, and smoking.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soils: As described in the Civil Plans.
- C. Unsatisfactory Soils: As described in the Civil Plans.
- D. Subbase Material: Material shall meet the crushed stone base MoDOT requirements of Section 1007 of the current Missouri Standards for Highway Construction, Type 1.
- E. Engineered Fill: Soil or granular fill containing sufficient fines to establish a moisture density relationship.
- F. Bedding Course: Material that meets the current specifications of MoDOT Type 1 or 5 granular material, or approved equal.
- G. Drainage Course: Rock course meeting the gradation requirements for a #67 rock as defined by ASTM C33.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

- A. Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to changes in work.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

- a. Ram hammering or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Excavate trenches to allow installation of top of pipe or conduit with a minimum cover of 48 inches (30" minimum cover for gas line trench) unless otherwise indicated on Plans.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 6 inches (150 mm) each side of pipe or conduit unless otherwise indicated on Plans.
- C. Trench Bottoms: Unless otherwise indicated on Plans, excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe. Remove projecting stones and sharp objects along trench subgrade.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
 3. All proof rolls shall be observed by a representative of Geotechnical Engineer.

- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation as directed by Engineer. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.
 - 1. Fill unauthorized excavations under pipe, or conduit as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring, bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Trenches shall not be backfilled until all required tests are completed and the utility systems, as installed, conform to requirements specified by the contract documents.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- D. Trenches under Footings: Place and compact backfill of Engineered Fill material to the bottom of the footings and a minimum 1 foot beyond edge of footings in all directions.
- E. Trenches under Pavement: Place and compact backfill of Engineered Fill to the bottom of the pavement rock base and a minimum 1 foot beyond edge of pavement in all directions.
- F. Backfill voids with satisfactory soil while removing shoring and bracing.
- G. Trenches outside of pavement, buildings, or structural areas: Place and compact initial backfill of Bedding Course, to a height of 12 inches (300 mm) over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
 - 2. Backfill remaining trench of Satisfactory Soil material, free of particles larger than 1 inch (25 mm) in any dimension, in 8" maximum lifts to the bottom of top soil layer.
- H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 5 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use satisfactory soil material.
 - 4. Under building slabs, use satisfactory soil material.
 - 5. Under footings and foundations, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within -2 to +4 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by +4 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 - 1. Under building slabs compact each layer of backfill or fill soil material at least 95 percent.
 - 2. Under walkways, structures, steps, and pavements, compact each layer of backfill or fill soil material to at least 95 percent.
 - 3. Under turf or unpaved areas, compact each layer of backfill or fill soil material to at least 95 percent to achieve bottom of topsoil layer elevation.
 - 4. For utility trenches, compact each layer to at least 95 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
 - 2. Pavements and walks: Plus or minus 1/2 inch (13 mm).

3.16 SUBBASE COURSE UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 - 1. Shape subbase course to required crown elevations and cross-slope grades.
 - 2. Place subbase course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - 3. Place subbase course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - 4. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 150 feet (45 m) or less of wall length, but no fewer than two tests.
 - 2. Paved Areas, sidewalks, and other potential structural areas: At each compacted fill and backfill layer, at least one test for every 10,000 square feet but in no case fewer than 3 tests per lift.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify and moisture condition or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Dispose of surplus satisfactory soil and topsoil per Owner.
- B. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

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END OF SECTION 312000

SECTION 321313- CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes concrete paving, including the following:
 - 1. Driveways.
 - 2. Roadways.
 - 3. Parking lots.
 - 4. Curbs and gutters.
 - 5. Walks.
- B. Related Requirements:
 - 1. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
 - 2. Section 321723 "Pavement Markings."

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Concrete paving Subcontractor (if applicable)

1.4 SUBMITTALS

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

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- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - C. Qualification Data: For qualified ready-mix concrete manufacturer.
 - D. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
 - E. Material Test Reports: For each of the following:
 - 1. Aggregates: Flint and chert will be limited to 1% maximum, by weight of the coarse aggregate, in all exposed concrete (case-in-place or precast). Lignite will be limited to 0.07% by weight of the fine aggregate in all exposed concrete.
 - F. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.6 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS**2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- C. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
- D. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars; assembled with clips.
- E. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.
- F. Deformed-Steel Wire: ASTM A1064/A1064M.
- G. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- H. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

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

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, Type I Portland cement.
2. Fly Ash: ASTM C618, Class C.
3. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, Portland-limestone cement.

- B. Normal-Weight Aggregates: ASTM C33, uniformly graded, certified to meet MoDOT Type D Rock per MoDOT Section 1005 "Aggregate for Concrete", uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Per MoDOT Section 1005 Aggregate for Concrete, Gradation D.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Durability factor:

1. Durability factor: AASHTO T 161 Procedure B, 75 percent minimum, all coarse aggregate sizes.

- D. Air-Entraining Admixture: ASTM C260/C260M.

- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

- F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

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- C. Water: Potable.
 - D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
 - E. White pigmented, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete according to ACI 301 requirements for concrete exposed to deicing chemicals.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content, 1-inch (25-mm) Nominal Maximum Aggregate Size: 6 percent minus 1 percent to plus 2 percent.
 - 2. Air Content, 3/4-inch (19-mm) Nominal Maximum Aggregate Size: 6 percent minus 1 percent to plus 2 percent.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete as required for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- E. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches plus or minus 1 inch.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.

2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius unless otherwise indicated on Plans. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.

- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by curing compound as follows:
 - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 1/2 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 6. Vertical Alignment of Dowels: 1/4 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 8. Joint Spacing: 3 inches.
 - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 10. Joint Width: Plus 1/8 inch, no minus.

- B. The paving tolerances noted above do not control in regards to site accessibility, and providing accessible routes in accordance with the American with Disabilities Act of 1990 and the 2010 ADA Standards for Accessible Design. Accessible routes shall meet the following:
1. Sidewalks shall not exceed 4.7% slope with a 1.7% cross-slope and shall be 5' wide except as noted on site plan.
 2. Parking areas for accessible spaces and access isles shall not exceed a 1.7% slope in any direction.
 3. Ramps shall not exceed 7.5% slope with a 1.7% cross-slope and shall be 5' wide except as noted on site layout plan. Rise of ramp shall not exceed 6".
 4. All sidewalk intersections shall have a 5' x 5' landing at 1.7% slope in all directions.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172 will be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 25 cu. yd. or fraction thereof of each concrete mixture placed each day and one test for each additional 50 cu. yd. placed.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Test data from concrete cylinder breaks will be evaluated using procedures of the American Concrete Institute (latest edition of ACI 214) to determine if the compressive strength of the concrete tested is acceptable.
- D. Test results to be reported in writing to Owner's representative, Engineer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture

proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.

B. Related Requirements:

1. Section 321313 Concrete Paving for constructing joints in concrete pavement.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data:

1. Concrete pavement joint sealants.
2. Joint-sealant backer materials.

- B. Samples for Initial Selection:** Manufacturer's standard color sheets, showing full range of available colors for each type of joint sealant.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

- D. Product Certificates:** For each type of joint sealant and accessory, from manufacturer.

- E. Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

- F. Preconstruction Compatibility and Adhesion Test Reports:** From joint sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint sealant backings have been tested for compatibility with and adhesion to joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backer materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealants for Concrete and Asphalt: ASTM D 6690, Types I, II and III.
 1. For use in parking lots only.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated as determined from preconstruction joint sealant substrate tests and field tests.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backers to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backer materials.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backer materials.
 - 3. Remove absorbent joint-sealant backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backer material installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants in accordance with the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- G. Hot-applied joint sealants shall not be used on sidewalks.

3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joints within concrete paving:

1. Joint Location:
 - a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.
2. Silicone Joint Sealant for Concrete: Single-component, nonsag.
3. Silicone Joint Sealant for Concrete: Single component, self-leveling.
4. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
5. Hot-Applied Joint Sealant for Concrete (Parking Lot areas only): Single component.
6. Joint-Sealant Color: As selected by Architect.

END OF SECTION 321373

SECTION 321723 - PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Painting and marking of pavement and curbs.

1.2 SUMMARY

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints.
- B. ASTM International (ASTM)
 - 1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.
- C. Federal Specifications (FS)
 - 1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I).
 - 2. FS TT-P-1952 - Paint, Traffic and Airfield Marking, Waterborne.

1.3 SUBMITTALS

- A. Product Data: For each pavement marking product. Include technical data and tested physical and performance properties.

1.4 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C), and not exceeding 95 deg F (35 deg C).

1.5 QUALITY ASSURANCE

- A. Use trained and experienced personnel in applying the products and operating the equipment required for properly performed work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.
- B. Waterborne Paint: Paints shall conform to FS TT-P-1952.
- C. Solvent Borne Paint: Paint shall conform to FS A-A-2886 or AASHTO M248. Paint shall be non bleeding, quick drying, and alkyd petroleum base paint suitable for traffic bearing surface and be mixed in accordance with manufacturer's instructions before application for colors White, Yellow, Blue, and Red.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Do not apply pavement marking paint until layout, colors, and placement have been verified with Engineer.
- B. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. New pavement surfaces shall be allowed to cure for not less than 28 days before application of marking materials.

3.3 APPLICATION

- A. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.
- B. Install pavement markings according to manufacturer's recommended procedures for the specified material.
- C. Following items shall be painted with colors noted below:

- 1. Pedestrian Crosswalks: White

2. Fire Lanes: Red if curbs are indicated to be marked in Civil Construction Plans.
3. Lane Striping where separating traffic moving in opposite directions: Yellow
4. Lane Striping where separating traffic moving in the same direction: White
5. ADA Symbols: Blue
6. ADA parking space markings: Blue as shown on the Civil Construction Plans.
7. Parking Stall Striping: White on Asphalt; Yellow on Concrete.
8. Curbs: White or Yellow as shown on the Civil Construction Plans.

3.4 FIELD QUALITY CONTROL

- A. Inspection: After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.

3.5 CLEANING

- A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION 321723

SECTION 32 8400 - PLANTING IRRIGATION**PART 1 - GENERAL****1.1 SUMMARY**

- A. General: Provide Planting Irrigation in accordance with requirements of the Contract Documents. Planting Irrigation within the context of this specification shall encompass furnishing all labor, materials, equipment, facilities, transportation and services to complete all water supply, irrigation system, and related work as shown on the Drawings and specifications herein.
- B. Related Work Specified Elsewhere
- C. Scope of work: The general extent of the irrigation system work is shown on the Drawings and may include, but is not necessarily limited to the following:
 - 1. Installation of all irrigation distribution equipment, such as driplines, etc.
 - 2. Installation of related control equipment, such as remote control valves, manual isolation valves, quick coupler valves, drain valves, etc.
 - 3. Installation of distribution piping, fittings, and appurtenances.
 - 4. Installation of sleeves under sidewalks.
 - 5. Installation of electronic controllers, including necessary electrical connections, low-voltage wiring, lightning protection, grounding, shielding, bonding, and sensors.
 - 6. Coordinate with and connect to provided water line including installation of piping, enclosure, backflow preventer and booster pump.

1.2 SUBMITTALS

- A. Procedures: Furnish technical data describing the quality and performance of each material component or system to be used in the Work as required by the Drawings or Specifications.
- B. Provide complete product submittals for each equipment item described within this section. Submittals shall indicate model selected and where more than one type shall be used, contractor shall indicate the intended application of each.
- C. Provide shop drawings of critical system areas including but not limited to: point of connection schematic with plumbing diagrams, controller and wiring diagrams, etc.

1.3 PROGRESS DRAWINGS

- A. Comply with applicable technical specifications.
- B. Accurately record locations of all piping and equipment that varies from what is shown on the Drawings horizontally to within one (1) foot and vertically to within 0.5 feet.
- C. Progress drawings shall be kept on-site and updated on a daily basis.

1.4 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Responsibilities: Contractor is solely responsible for quality control of the Work.
- B. The publications and standards listed below form a part of this specification to the extent referenced. The publications and standards are referred to in the text by the basic designation only.
- C. American Society for Testing and Materials (ASTM)
 - 1. A536 – Standard Specification for Ductile Iron Castings
 - 2. AF477-14 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 3. B 62-85 - Standard Specifications for Composition Bronze or Ounce Metal Castings
 - 4. D 1784-81 - Standard Specifications for Rigid (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
 - 5. D 1785-86 - Standard Specifications for (PVC) Plastic Pipe, Schedules 40 and 80
 - 6. D 2241-84 - Standard Specifications for PVC Pressure-Rated Pipe (SDR Series)
 - 7. D 2564 - Standard Specifications for Solvent Cements for (PVC) Plastic Pipe and Fittings
 - 8. D3239 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 9. F477 - Specification for Electrometric Seals (Gaskets) For Joining Plastic Pipe.
- D. Standards: Comply with all applicable provisions of the latest edition of the following codes:
 - 1. UPC Uniform Plumbing Code
 - 2. BOCA Buildings Officials and Codes Administrators
 - 3. UBC Uniform Building Code
 - 4. NEC National Electric Code
 - 5. Institute of Electrical and Electronics Engineers – IEEE 1100-1999 Recommended Practice for Powering and Grounding Electronic Equipment
 - 6. Plastics Pipe Institute (PPI) recommendations for hydrostatic design stresses for PVC pipe.
 - 7. Local codes and jurisdiction requirements for Columbia, Missouri.
- E. Permits and Fees: Contractor is responsible to obtain all required permits and pay all associated fees unless otherwise noted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store PVC pipe in a neat and orderly manner fully supported and protected from sunlight.
- B. All equipment shall be delivered, unloaded and handled so as to protect from damage at all times.

1.6 PROJECT / SITE CONDITIONS

- A. The project consists of the following types of irrigation on site:

1. Dripline irrigation.
2. Deep root watering tubes

- B. PVC shall not be cemented during wet conditions per the discretion of Owner's Representative.
- C. Trench excavation and backfilling shall not be performed during excessively wet conditions per the discretion of Owner's Representative.
- D. Multiple utility corridors are proximal to irrigation piping and equipment. Contractor shall familiarize himself with the other scopes of work and ensure all utilities are field located prior to beginning work.

1.7 SEQUENCE AND SCHEDULING

- A. The Contractor shall be solely responsible for coordinating, sequencing and scheduling all work with all applicable trades and/or sub-contractors so as to insure proper and timely performance.

1.8 CONTRACTOR WARRANTY

- A. Conform to applicable Division Two specifications.
- B. Contractor shall provide a written warranty covering the entire system against defects in installation, workmanship and equipment for a period of one year from date of Final Acceptance.
- C. After the system is installed and approved, instruct groundskeeper personnel and maintenance staff in the complete operation, winterization, and maintenance of the system.

1.9 MANUFACTURER'S WARRANTY

- A. Warranty period shall begin at Substantial Completion.
- B. Contractor shall provide Owner with a warranty transfer that shall confer all applicable product warranties and replacement benefits to the Owner upon final acceptance.
- C. Provide this warranty transfer for each manufacturer whose products have been installed on the project.

1.10 MAINTENANCE

- A. Service: Contractor shall service and maintain system until the work has been deemed Substantially Complete.
- B. Irrigation shall be under full automatic operation for a period of two days prior to any planting in a given area.

- C. The Contractor shall winterize the irrigation system in the fall of the first year and re-start system in the following spring.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Manufacturer: Subject to compliance with requirements, provide products of the following:
 - 1. Hunter Industries
 - 2. Rain Bird Corporation
 - 3. Approved Equal
- B. Use only new materials of brands shown on Drawings, specified herein or as acceptable to the Owner's Representative.

2.2 PIPE MATERIALS

- A. Ductile Iron Pipe with Mechanical Joints: AWWA C151 with mechanical joint bell and spigot ends.
 - 1. Mechanical Joint Ductile Iron Fittings: AWWA C110 ductile or gray iron standard pattern or AWWA C153, ductile iron compact pattern
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile or gray-iron glands, rubber gaskets and steel bolts.
- B. Soft Copper Tube: ASTM B88, Type L water tube, annealed temper
 - 1. Copper pressure fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper solder-joint fittings. Furnish wrought copper fittings if indicated.
 - 2. Bronze Flanges: ASME Class 150 with solder-joint end.
 - 3. Copper Unions: MSSSP-123 cast-copper-alloy, hexagonal-stock body with ball and socket, metal-to-metal seating surfaces and solder joint or threaded ends.
- C. Plastic Pipe: All pipe and hose is free of blisters, internal striations, cracks or any other defects or imperfections. The pipe and hose are continuously and permanently marked with manufacturer's name, material type, size, and schedule or class and quality control identifications.
- D. Mainline 2-1/2 inches and smaller: Solvent-weld PVC pressure pipe, SDR 21, manufactured from PVC compounds conforming to ASTM D1784.
- E. Laterals: Solvent-weld PVC pressure pipe, SDR 21, manufactured from PVC compounds conforming to ASTM D1784.
 - 1. Lateral: Class 200 (SDR 21); uniformly white in color.

- F. Sleeves: All new sleeves shall be PVC Schedule 40. Install sleeves in locations as shown on the drawings and at the depths specified for laterals and mainlines.

2.3 FITTINGS

- A. Metallic: Cast bronze with standard iron pipe thread; 125 lb. class rating in conformance with ANSI B16.15.
- B. Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion. These devices are a combination of copper alloy and ferrous metal; threaded- and solder-end types, matching piping system materials.
- C. Dielectric Unions: Factory-fabricated, union assembly, designed for 250 psig minimum working pressure at 180° F (82° C). Include insulating material isolating dissimilar metals and ends with inside threads according to ASME B1.20.1.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150 psig or 300 psig minimum pressure to suit system pressures.
- E. Transition Fittings: Manufactured assembly or fitting, with pressure rating at least equal to that of system and with ends compatible to piping where fitting is to be installed.
- F. Copper: ANSI B16.22 wrought copper or cast brass, recessed solder joint type fittings
- G. Plastic:
 - 1. Mainline 2-1/2 inch or smaller: Same as lateral.
 - 2. Lateral: ASTM D 2467, Schedule 40, socket type, Type 1, Grade 1 polyvinyl chloride (PVC) with solvent weld or threaded connections in conformance with ASTM D1784 and D2466: uniformly white in color.
- H. Nipples:
 - 1. Metallic: Schedule 40 red brass (35% copper, 15% zinc) pipe: threaded both ends. Pipe shall be in accordance with ASTM B43.
 - 2. Plastic: Factory-threaded Schedule 80, Type 1, Grade 1 polyvinyl chloride (PVC) pipe, threaded both ends. Pipe shall be in conformance with ASTM D1784 and D1785. Color: gray.

2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch thick unless otherwise indicated full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

- D. Solder Filler Materials: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.
- F. Gaskets and Fasteners for Metal and Metal-to-Plastic Flanged Joints: ASME B16.21, nonmetallic, asbestos-free, flat, 1/8-inch thickness gaskets and ASME B18.2.1, carbon steel bolts, nuts, and washers.
- G. Gaskets for Plastic Flanged Joints: Materials recommended by plastic pipe and fitting's manufacturer.

2.5 VALVES

- A. Gate Valves:
 - 1. Brass Gate Valves, 2-1/2 Inches (75 mm) and Smaller:
 - a. Full port, cast brass with non-rising stem and threaded bonnet. Threaded ends shall conform to ANSI Standards B2.1. Provide brass cross handle.
 - b. Threaded connection to pipe shall be made via SCH 80 PVC Nipples. No male adapters shall be accepted.
 - c. 514 Brass Gate Valve by Matco-Norca, 1-800-688-2583 matco-norca.com
 - d. Approved equal.
- B. Master Valve:
 - 1. Rainbird 200-PEB-PRS-D, 1.5 inch size with "Pressure Dial" flow control.
 - a. Approved equal
- C. Electric Remote Control Valves: All electric remote control valves shall be of the size and type as specified on the drawings.
 - 1. Rainbird 100-PGA-PRS-D, 1 inch size with "Pressure Dial" flow control.
 - a. Approved equal
- D. Quick Coupler: 3/4-inch inlet, 2 piece body, purple locking cover, model 33-DLRC by Rainbird.
 - 1. Approved equal
- E. Valve Boxes: Valve boxes shall be of a variety as produced by Armor Access Boxes, Carson, or acceptable equal. Provide green valve box covers.
 - 1. Manual Isolation Valve boxes: All valve boxes for manual isolation valves will be round boxes with twist-off type lids.
 - 2. Remote Control Valve boxes: All valve boxes for remote control valves will be rectangular boxes (12") with vandal-resistant, locking lids.

3. Quick Coupler Valve boxes: All valve boxes for quick coupler valves will be round boxes (9") with locking lids.

2.6 DEEP ROOT WATER TUBES

- A. Rainbird RWS-B-C-1402, 36" long with check valve.

2.7 DRIP IRRIGATION EQUIPMENT

- A. Emitter Hose: Rainbird XFD Series Dripline; XFD-06-12 (or approved equal)
- B. Subterranean Box: The emitter box shall be manufactured by Armor Access Boxes, Carson, or approved equal and shall fit Hunter Drip Zone Kit. Box shall consist of rugged UV-resistant thermoplastic construction. The emitter box body and cap shall be black in color. Two slots in the bottom of the box shall be provided to allow for installation of distribution tubing onto the emission device. The dimensions on the unit shall be as follows: Height = 10.25", Top Diameter = 5.0", Base Diameter = 7.75".
- C. Drip Zone Kit: Rainbird XCZ-100-PRB-COM.
- D. Flush Valves: Rainbird East Fit Coupling and Flush Cap.
- E. Air Relief Valves: Rainbird Air Relief Valve.
- F. Compression Fittings: Manufacturer approved compression or barbed fitting shall be used to connect ½" polyethylene tubing (.630"-.710", or 16mm-18mm outside diameter) to the following threaded components:
 1. ½" and ¾" Male Pipe Thread
 2. ½" and ¾" Female Pipe Thread
 3. ¾" Female Hose Thread

2.8 AUTOMATIC CONTROL SYSTEM

- A. Controller
 1. Rainbird ESP-ME3 Series Controller, ESP4ME3 (3 station base model)
- B. Modules
 1. Rainbird ESPSM6, 6 station module
 2. Rainbird LNK2WIFI, Wifi module for remote control

2.9 SENSORS

- A. Sensors shall be matched to the controller and central control software. Basis of design products specified below. Any equivalent products must provide the same features and functionality and be matched to any proposed equivalent central control software.
- B. Rainbird Wireless WR2 Rain & Freeze Combo.

2.10 EARTH GROUNDING

- A. It is the responsibility of the Contractor to provide earth grounding for all electrical equipment installed by him in relation to the irrigation control system. Said grounding shall include but not be limited to the items described in the following paragraphs.
- B. Components: The contractor shall use UL listed grounding electrodes or those that meet the minimum requirements of the National Electrical Code (NEC) at each controller location. At the very minimum, the contractor shall install a copper clad steel ground rod, a copper ground plate and 100 pounds of earth contact material, as defined herewith and per following detail.
 - 1. Circuit Resistance: The earth-to-ground resistance of this circuit shall be measured using a Megger, or other similar instrument, and the reading shall be no more than 10 ohms. If the resistance is more than 10 ohms, then additional ground plates and earth contact material shall be installed in the direction of an irrigated area.
 - 2. Electrode Spacing: To prevent the electrode-discharged energy from re-entering the underground wires and cables, all electrodes shall be installed away from said wires and cables. The spacing between any two electrodes shall be 16 to 20 feet, so that they don't compete for the same soil.
 - 3. Connections: All ground circuit connections shall be made using an exothermic welding process. Solder shall not be allowed to make connections. The wires are to be installed in as straight a line as possible, and if it is necessary to make a turn or a bend it shall be done in a sweeping curve with a minimum radius of 8" and a minimum included angle of 90 degrees. Mechanical clamps shall be permitted temporarily during the resistance test process, but shall be replaced with exothermic welds immediately thereafter.
 - 4. Soil Moisture: It is recommended that the soil surrounding all the copper electrodes be kept at a minimum moisture level of 15%. The use of salts, fertilizers and other chemicals shall not be allowed to improve soil conductivity because these materials are corrosive and will cause the copper electrodes to become less effective with time.
 - 5. Shielding: The shielding requirements for wires and cables shall consist of the installation of a network of 6 AWG solid bare copper wire over the main bundles of wires and cables as shown in the details and described herein. The 6 AWG wire shall be installed 8" below finished grade. This bare conductor shall be placed above all other valve/power/communication wires and cables per detail. The conductor shall be laid in as straight a line as possible, and when necessary to make bends, they shall be made in a sweep style. It is not necessary to install this conductor over short wire runs (less than 150 feet) away from the main bundles. This 6 AWG bare copper wire shield network shall be connected to all controllers ground lug, which in turn are connected to grounding electrodes.

6. Bonding: All supplementary grounds for each controller will be bonded to the service entrance ground, per the requirements of the NEC and IEEE standards. The shield wire network as described above shall be used to bond each supplementary ground to the service entrance ground.
7. Bare Copper Wire Connections (Shield and Bonding Wires): When joining bare copper wires, it shall be done using an exothermic welding process. Wire connectors, terminal ends, lugs or other types of connectors are not acceptable alternatives.

2.11 WIRING

- A. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 1. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 2. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 3. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.12 SUPPORTING DEVICES

- A. Provide all necessary inserts, fasteners, clamps rods, hangers, saddles, supports, anchor bolts, nuts, washers, and steel plates and shapes as required to properly support all piping and equipment included under this section.
- B. Supporting devices shall be as manufactured by Grinnell or equivalent, and recommended for the application.

2.13 MISCELLANEOUS TOOLS & EQUIPMENT

- A. Pipe Detection Tape: "Sentry Line" three (3) inch wide, detectable, "Caution Water Line Buried Below" tape as available from Terra Tape Inc. Houston, Texas (800)-231-6074 or acceptable equal.
- B. Valve Tags: Provide identification tag on flow control handle shaft, aluminum, plastic or other durable material, with valve station and controller number identified in 1/8" minimum letters.
- C. Drainage Backfill: Provide and install clean gravel or crushed stone, graded from 3 inches maximum to 3/4 inch minimum.
- D. Pipe Labels: Self-adhesive labels indicating flow direction, with 'IRRIGATION' lettering. Install at appropriate intervals on all exposed supply piping upstream and downstream of the pump.
- E. Thrust Blocking: Poured-in-place concrete, 3000 psi (28 days) minimum compressive strength.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.
- B. The Contractor shall install all irrigation system components in accordance with the Irrigation Plans, Details and these Specifications. The workmanship of the entire job must in every way be first class, and only experienced and competent persons will be allowed to work on the project.
- C. Supervision: The Contractor, personally or through an authorized and competent representative shall supervise the work constantly, and shall, as far as possible, keep the same foremen and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen shall be utilized for installation
- D. Schedule of Work: The Irrigation Contractor shall be responsible for the installation of the piping and equipment in a manner that will affect the earliest completion of the work in conformance with the construction progress schedules of other Contractors and Trades, and these Specifications.
- E. Observations: In addition to normal progress inspection, the Contractor shall give at least 72 hours' notice to Owner's Representative for observation of the work as follows:
 - 1. Layout of the system
 - 2. Observation of trenches, backfilling and equipment
 - 3. Pressure tests and flushing operation
 - 4. Coverage adjustment
 - 5. Automatic operation

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."
- B. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.
- C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- D. Provide minimum cover over top of underground piping according to the following:
 - 1. Irrigation Main Piping: Minimum depth of 24 inches below finished grade.
 - 2. Lateral Piping: 12 inches.

- 3. Drain Piping: 12 inches.
- 4. Sleeves: 24 inches.

3.3 PROTECTION

- A. The Contractor shall be responsible for storage of materials and any damage to the work covered by these Specifications before the final acceptance of the work.
- B. Protect work and materials from damage during construction. Storage of polyvinyl chloride (PVC) pipe and fittings shall be protected from direct sunlight. Beds on which materials are stored must be the full length of the pipe to avoid damage. Any pipe that has been damaged or dented shall not be used in the work.
- C. Any existing structures, equipment, utilities, pavement, landscaping, etc., damaged by Irrigation Contractor during the course of the work, including any damage caused by leakage or settling of piping systems being or having been installed by them, shall be restored at Contractor's expense and to the Owner's satisfaction.
- D. Securely cover openings into the system and cover apparatus, equipment, and appliances, both before and after being set in place, to prevent obstruction in the pipes and the breakage, misuse or disfigurement of the apparatus, equipment or appliances.
- E. Where mainlines have no wiring present, provide a dedicated tracer wire by taping (with electrical-rated tape) to the top of the pipe at 10-foot intervals along the entire length of the pipe. Also provide 24-inch coiled wire at all termination points.

3.4 LAYOUT AND VERIFICATION

- A. The Contractor shall stake the locations of all pipe circuits, quick coupling valves, and irrigation heads in accordance with the Drawings. The Contractor shall check and verify dimensions of layout and report variations to the Owner's Representative proceeding. Layout work as accurately as possible to the drawings.
- B. Minor changes in locations to the above from locations shown shall be made as necessary to avoid existing or proposed planting, piping, utilities, structures, etc., at the Contractor's expense, or when directed by the Owner's Representative, providing such change is ordered before such items or work directly connected to same are installed, and providing no additional materials are required.
- C. The Contractor will be held responsible for the relocating of any items without first obtaining the Owner's Representative approval. The Contractor shall remove and relocate such items, at his expense, if so directed by Owner's Representative.
- D. Before starting work on irrigation system, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths. The Contractor shall be aware of the fact that the drawings are horizontal dimensions.

- E. No fittings shall be installed on pipe underneath pavement or walls except where noted on the Irrigation drawings. If such a need should occur, the Contractor shall bring it to the attention of Owner's Representative.
- F. Exact sprinkler head placement is based on and shall be coordinated with actual planting layout and shall be verified by Owner's Representative.

3.5 TRENCHING, BORING AND ENCASEMENT

- A. Make trenches for main and laterals straight and true with the bottoms graded on uniform slopes to low points. Excavate trenches wide enough to allow a minimum of 4" (100 mm) between parallel pipe lines, 8" (200 mm) from lines of other trades. Do not install lines parallel and directly over one another. Maintain 2" (50 mm) vertical clearance between irrigation lines; minimum transverse angle is 45 degrees. A maximum of 2 lines per trench. No irrigation lines shall extend above subgrade.

3.6 BEDDING

- A. All mainline pipe shall be bed in trenches per the relevant Details.

3.7 PIPELINE ASSEMBLY

- A. General:
 - 1. Provide flanges or unions as indicated and as necessary to allow removal and re-installation of any item of equipment or accessory without cutting, welding or soldering.
 - 2. Provide discharge piping of proper size for all backflow air vent, solenoid, and relief valves. Extend to nearest drain.
 - 3. Cut pipe to measurements established at the site. Work into place without springing or forcing.
 - 4. Protect all openings in piping during construction to prevent entrance of foreign matter.
 - 5. Cut pipe and tubing ends square. Remove rough edges and burrs so that a smooth and unobstructed flow will be obtained.
 - 6. Close or short nipples should be used only where shown on the drawing, or absolutely necessary to satisfy dimensional constraints.
 - 7. Make changes in pipe size using reducing fittings. Use bushings only if shown on the drawings.
 - 8. Connections to equipment or accessories shall be threaded for sizes 2" and smaller; flanged for sizes 2-1/2" and larger.
 - 9. Arrange exposed piping straight, parallel and perpendicular to the walls of the structure unless otherwise shown on the drawings.
 - 10. Wherever two or more pipes are installed in parallel, allow sufficient space for required welding, soldering, painting, and/or the application of insulation.
- B. Installation of all pipes and fittings shall be in strict accordance with the manufacturer's written specifications. Deviations from these specifications shall be permitted only with the written approval of Owner's Representative.

- C. Plastic pipe and fittings 2-1/2 inches and smaller shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where screwed connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.
- D. Install PVC pipe in dry weather when temperature is above 40 degrees F in strict accordance with manufacturer's instructions.
- E. Pipe may be assembled and welded on the surface. Snake pipe from side to side of trench bottom to allow for expansion and contraction.
- F. Connections between plastic pipe and metal valves shall be made using plastic male adapters and applying the recommended threaded joint compound.
- G. All metal screwed joints shall be tightened with tongs or wrenches and employ the specified joint compound. Caulking of any kind will not be permitted.
- H. Tape all plastic threaded connections with Teflon tape.
- I. All lines to be laid under hard surfaces shall be installed in a PVC Schedule 40 sleeve. Depth of sleeves to be determined by the type of line that is to be placed in sleeve. In the case of new construction, all sleeves are to be place prior to lying of any hard surface. All sleeve locations shall be marked with a brass marker placed in the curb in accordance with the details.
- J. Core drilling for irrigation piping penetrations shall be accomplished in a manner approved by the Owner. Provide metal sleeves for all irrigation lines wherever passing through a concrete wall or floor. Provide a water stop or membrane clamp for every pipe or sleeve penetrating an exterior concrete wall or floor; whichever is appropriate to the waterproofing method.

3.8 AUTOMATIC CONTROLLER

- A. The automatic controller shall be provided with direct surge protection. The Contractor shall verify power location and type, as well as power connection requirements at that location. The Contractor shall be responsible to successfully connect the power to the controller. The location of the controller shall be as shown on the drawings, and as directed by the Owner's Representative.
- B. The controller shall be earth grounded as shown on the drawings.

3.9 ELECTRICAL CONTROL WIRES

- A. The wire paths shall be installed in the same trench as the main line wherever possible. Cable shall be laid alongside the pipe by "snaking" in to the trench to allow as much slack as possible for contraction and expansion of the wire.
- B. The wire splice shall be absolutely waterproof so that there is no chance for leakage of water and corrosion build-up on the connection. All wiring shall be accomplished with as few splices as possible.

- C. Mainline runs with solenoid wires or two-wire path present shall be shielded with a 6 AWG solid bare copper wire installed per the plans and details. Shield wire may be utilized for bonding requirements as well.
- D. Tracer wire shall be installed along all PVC piping.

3.10 FIELD QUALITY CONTROL

- A. Notify Owner's Representative for the following reviews, with 10 working days minimum notice:
 - 1. Pressure testing mains and laterals
 - 2. Coverage test prior to planting
 - 3. Pre-maintenance observation
 - 4. Final observation
- B. Provide equipment and/or personnel required to conduct tests.
- C. Provide up-to-date Progress Drawings at each review
- D. If Owner's Representative is called out for review prior to the system being ready, the contractor will be back-charged for the cost of the review including all associated travel, fees, and expenses.

3.11 CLOSING OF PIPE AND FLUSHING LINES

- A. Closing: Openings in laterals and main shall be capped or plugged, leaving caps and plugs in place until removal is necessary for completion of installation. Contractor shall take other precautions as necessary to prevent dirt and debris from entering pipe or equipment.
- B. Flushing: Lines shall be thoroughly flushed out before installing quick coupling valves sprinklers or emitters. (After flushing, main line pipe may be partially backfilled, butt joints, fittings and connections shall remain free and visible).
- C. Test in accordance with paragraph on Hydrostatic Test. Upon completion of the testing, the Contractor shall complete assembly and adjust sprinkler heads for proper distribution.

3.12 PURGING

- A. Immediately prior to hydrostatic testing, all irrigation lines shall be thoroughly purged of all entrapped air. Introduce water into lines to be tested at full operating head. Observe water flow at end of discharge point until determination is made that all air and residual debris has been expelled from the line.

3.13 HYDROSTATIC TESTING

- A. While the necessary piping system components are exposed, all mainline piping is to be subjected to a hydrostatic test. Owner's Representative should be on premises for overall check of the system.
- B. Do not install remote control valves, quick couplers, or any other valve assembly until Owner's Representative accepts testing of pressure main lines.
- C. Testing shall occur with joints open. Small amounts of backfill between fittings shall be allowed to prevent pipe displacement. All fittings shall be visible prior to testing.
- D. Pressure gauges shall be read in PSI. Calibration shall be such that accurate determination of potential pressure loss can be ascertained.
- E. Test pressure supply lines under hydrostatic pressure of 125 PSI minimum. Pipe shall hold pressure for a period of one (1) hour with no more than five (5) PSI lost in order to pass test.
- F. Lateral lines shall be tested under full line pressure for a period of one (1) hour before backfilling. Cap all heads and center load pipe between fittings before testing.
- G. Re-test as required until the system meets the requirements. During the tests, regardless of the amount of leakage, all detectable leaks are to be stopped and all defects corrected.

3.14 BACKFILLING AND COMPACTING

- A. Rock free backfill material for mainline pipe is to be tamped in 4" (100 mm) layers under the pipe and uniformly on both sides of the full width of the trench or as shown, and the full length of the pipe. Materials are to be sufficiently damp to permit thorough compaction under and on each side of pipe, to provide support free of voids. PVC pipe is not to rest on concrete, rock, wood blocks, or similar items.
- B. All pipe is to be immediately backfilled with preliminary backfill sufficient to prevent arching or slipping under pressure.
- C. Other than for preliminary backfill over pipe, do not allow or cause any of the work to be covered before it has been inspected, tested and approved by the Owner's Representative.
- D. Upon approval of Owner's Representative, proceed to place remaining backfill. Backfill material will be clear of all debris and rocks larger than 2" (50 mm) in diameter. Finish grade of all trenches must conform to adjacent grades without dips, sunken areas, humps or other irregularities. Dispose of excess debris.
- E. Restore all surfaces, existing underground installations, damaged or cut as a result of the excavations to their original condition.

3.15 ADJUSTING THE SYSTEM

- A. Adjust alignment and coverage of all heads. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make all necessary changes or make arrangements with the manufacturer to have adjustments made, prior to any planting. These changes or adjustments shall be made without additional cost.
- B. Adjust and balance system to eliminate over spray and fogging and as directed by the Landscape Architect.

3.16 TURN-OVER MATERIALS

- A. Final Record Drawings: Two sets of these shall be produced, one for placement at or within the appropriate irrigation controller cabinet reduced to 11" x 17" and one full size set for storage at another location desired by the Owner's Representative.
 - 1. Both sets shall have the entire irrigation valve zone lateral lines color-coded so as to readily distinguish between adjacent zones. The valve size, station number and gallons per minute shall be legible at each valve and shall match how the controller is wired. Additionally, each valve shall be annotated to describe which type of irrigation it is, i.e.: spray, rotor, bubbler, etc. Color-coded copies shall then be professionally laminated in 5 mil clear plastic.
 - 2. In addition to the laminated plans, a digital spreadsheet (in excel format) shall be provided illustrating zone numbers, precipitation rates, plant type, and zone description/location. These items should be neatly organized in separated columns within the spreadsheet file.
- B. Operational and Maintenance Data: Contractor shall submit two copies of manufacturer's data, O&M manuals, record drawings, maintenance and operational schedules, and inventory of turn-over and salvaged materials, labeled and indexed in a three-ring binder.

3.17 WARRANTY AND MAINTENANCE INSTRUCTIONS

- A. Fill and repair all depressions and replace all planted areas due to the settlement of irrigation trenches for one year following the completing and acceptance of the job. Use only approved planting soil materials.
- B. Drain the irrigation system in the fall of the first year, and start in up the following spring.
- C. Instruct Owner's personnel in complete and proper operation, maintenance and winterization of the system prior to Final Acceptance.
- D. Contractor shall provide a digital media recording of all operational, maintenance and winterization procedures for each component aspect of the irrigation system.
- E. Provide Owner's Representative with a three-ring binder including all O&M manuals, record drawing submittals, turnover materials, salvaged items and warranty requirements prior to Final Review.

BINGHAM HALL – UPDATE COURTYARD AREA

UNIVERSITY OF MISSOURI

ISSUED FOR BID

END OF SECTION

SECTION 329250 – LANDSCAPE STONE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Single-depth dry-stacked stone retaining walls.
 - 2. Outcropping landscape stone.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavation and backfill for retaining walls.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Indicate layout of stone(s), edging and curbs, dimensions of areas, elevations, and affected adjacent construction.
- C. Samples: For each finish specified, two sample boards, minimum size of 6 inches square, representing actual product, color, and veining.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Contractor shall have documented experience of at least five projects of similar construction and scope. Provide brief description of each project and name and contact information of owner's representative with knowledge of each listed project.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and handle stone and related materials to prevent damage and deterioration. Protect from weather with waterproof, non-staining covers, but allow air to circulate around stones.
- C. Prevent excessive mud, fluid concrete, or other deleterious materials from coming in contact with and affixing to landscape stone materials.

1.7 PROJECT CONDITIONS

- A. Do not place backfill when subgrade is wet or frozen.
- B. Do not place backfill during wet or freezing weather that prevents conformance with specified compaction requirements.
- C. Cold Weather Protection: Protect stonework from freezing. Do not lay stonework when temperatures are below 40 degrees within a 24 hour period. Replace any stone damaged by freezing conditions.

PART 2 - PRODUCTS**2.1 OUTCROPPING LANDSCAPE STONE**

- A. Basis of Design Manufacturer: Provide stone materials by Sturgis Material, 550 South Packard, Kansas City, KS 66119 or approved equal.
- B. Buckskin Weathered Edge Outcropping Landscape Stone
 - 1. Tops and Bottoms: Natural Smooth, flat beds.
 - 2. Sides: Split on three sides.
 - 3. Sizes:
 - a. Thickness: 18 inches.
 - b. Depth: 24 inches.
 - c. Lengths: Random, ranging from 48 inches to 60 inches.
 - 4. Color Range: Natural golden tan and brown.
 - 5. Texture: Seam and stratified weathered face.

2.2 ACCESSORY MATERIALS

- A. Crushed Limestone Fill: Granular limestone fill graded as follows:
 - 1. 100 to 75 percent passing a 2-inch sieve.
 - 2. 100 to 75 percent passing a 3/4-inch sieve.
 - 3. 100 to 20 percent passing a No. 4 sieve.
 - 4. 0 to 60 percent passing a No. 40 sieve.
 - 5. 0 to 35 percent passing a No. 200 sieve.

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- B. Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured according to test methods referenced.
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 4. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify substrate is level, smooth, and capable of supporting landscape stone imposed loads.
- C. Verify grades, contours and elevations of substrate are correct.
- D. Verify substrate base supporting landscape stone has been properly compacted.

3.2 PREPARATION

- A. Clean surfaces thoroughly from debris, roots, branches and extraneous materials 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.

3.3 DRY-STACKED STONE WALLS INSTALLATION

- A. Install stone in accordance with manufacturer's instructions.
- B. Lay out walls to the lines and grades indicated on the drawings. Use string line and stakes to mark off any straight portions and marking paint to lay out curve portions.
- C. Compact earth subgrade to a density of 95% at optimum moisture content in accordance with ASTM D-698 Standard Proctor Method.
- D. Prepare a trench base that follows the string line or marking paint. Trench should be a minimum of 6 inches deep by 6 inches wider than the stone.
- E. Fill the trench with 4 inches of 3/4 inch aggregate. Level and compact the aggregate thoroughly with a plate compactor and add 2 inches of crushed limestone on top of the compacted stone.

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- F. Level the base course of stone by placing the first layer of stone on the crushed limestone base. Check for level front to back and side to side and adjust accordingly with a large mallet.
 - G. Stack the second course on top of the base course. Do not line up the seams between the stones from one course to another. Select stones that fit well with those on either side. If there are large gaps, use a stone splitter to achieve a snug fit. Shim the stones as required to eliminate wobbling.
 - H. If the wall is noted larger than 3 feet high, place a perforated drain tile behind the base course and then buried by the drainage aggregate backfill.
 - I. Each course of stone should be set back 2 inches at Raingarden retaining wall locations to allow the wall to lean back into the ground that it will be retaining. Shim the back of the stones to eliminate wobbling.
 - J. Progressively backfill the wall with the drainage aggregate after each course is stacked. Prior to backfilling, lay the geotextile filter fabric beneath the bottom course, and lap against the back face of each consecutive stone coursing, placing the drainage aggregate between the fabric and the sloped grade. The aggregate shall be a minimum of 12 inches from the wall to the excavated grade at the base of the wall, and slope at a 1:3 angle. Compact each layer of aggregate thoroughly.
 - K. Finish the top of the wall with well-fitted stones matched to the wall configuration.

3.4 PROTECTION AND CLEANING

- A. Clean exposed faces to remove dirt and stains which may be on units after erection.
- B. Wash and rinse stone in accordance with manufacturer's recommendations. Do not use cleaning materials or processes which could change the natural character of the exposed finishes. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh fillers.
- C. Protect installed products until completion of the project.
- D. Protect adjacent work areas and finish surfaces from damage during product installation.
- E. Adjust or reset any materials disturbed by successive operations.
- F. Replace damaged stones which are loosened, broken, chipped, stained, or otherwise damaged prior to Substantial Completion.

END OF SECTION 329250

SECTION 334200 – STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Cleanouts.
 - 3. Manholes.
 - 4. Drop Inlets.
 - 5. Stormwater Inlets.
 - 6. Stormwater outfall structures.
 - 7. Pipe outlets.

1.3 SUBMITTALS

- A. Product Data: For all manufactured and fabricated products.
- B. Shop Drawings:
 - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 - 2. Catch Basins, stormwater inlets, outfall structures, and junction boxes: Include plans, elevations, sections, details, frames, covers, and grates.
 - 3. Pipe materials.
 - 4. Bedding material.
- C. Product Certificates: For each type of pipe and fitting, from manufacturer.
- D. Field quality control reports.

1.4 QUALITY ASSURANCE

- A. Stop work and notify Owner and Engineer when jack and bored pipe installation is complete, for inspection and testing prior to continuation of storm sewer installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle catch basins in accordance with manufacturer's written rigging instructions.
- D. Handle manholes in accordance with manufacturer's written rigging instructions.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
 - 1. Notify Owner no fewer than five working days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.
 - 3. Protection and Restoration of Work Area: Use reasonable care to avoid damaging existing buildings, equipment, site improvements, and vegetation to remain. Contractor shall be liable for cost of damages caused by failure to use reasonable care.
 - 4. New site storm sewer outfall and connection to existing storm sewer system shall be constructed and fully operational prior to disconnection and abandonment of existing site storm sewers. Contractor shall be responsible for any water or flood damage to buildings.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. High Density Corrugated PE Pipe with integrally formed smooth waterway AASHTO M 252 and M294, Type S or ASTM F2648 (engineered compound).
 - 1. Bell and spigot soil-tight, gasketed joints. Gaskets shall be installed by the manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

2.2 PVC PIPE AND FITTINGS

- A. PVC Sewer Piping:
 - 1. Pipe: ASTM D 3034, SDR 26, PVC sewer pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM D 3034, PVC with bell ends.
 - 3. Gaskets: ASTM F 477, elastomeric seals.
- B. Fusible PVC Sewer Piping:
 - 1. Pipe: AWWA C905, Class DR 25 fusible PVC

2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Concrete Pipes: ASTM C 443, rubber.
 - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
 - 1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 CLEANOUTS

- A. Plastic Cleanouts:
 - 1. Description: PVC or HDPE body with either PVC top or cast iron frame and lid depending on location. See Plan for details.

2.5 STORMWATER INLETS

- A. PVC Inlets: Per Plans.
- B. Concrete Inlets: Precast or cast in place and as shown in the Plans.

2.6 CONCRETE

- A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350 and the following:
 - 1. Cement: ASTM C150/C150M, Type II.
 - 2. Fine Aggregate: ASTM C33/C33M, sand.
 - 3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: **2** percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: **4** percent.

2.7 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Top Section: flat-slab-top type is indicated.
4. Joint Sealant: ASTM C990 bitumen or butyl rubber.
5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
6. Steps: ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP, or approved equal, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch(44T) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
7. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading.

PART 3 - EXECUTION

3.1 EARTHWORK

- #### A.
- Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- #### A.
- Locations and Arrangements: Drawing plans and details indicate location and arrangement of underground storm drainage piping. Location and arrangement of piping layout takes into account design considerations. Install piping as indicated.
- #### B.
- Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

- C. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping to depths indicated in Plans. Minimum cover for HDPE pipe shall be maintained per manufacturer's Specifications.
 - 3. Install PE corrugated sewer piping according to ASTM D 2321 and manufacturer's written instructions.
 - 4. Install PVC profile gravity sewer piping as detailed in Plans.
 - 5. Install reinforced-concrete sewer piping as detailed in Plans.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - 2. Join reinforced-concrete sewer piping according to current MoDOT requirements.

3.4 BEDDING OF PVC STORM SEWER PIPE

- A. Lay pipe with solid bearing throughout its length. All bedding shall be per Plans and in conformance with AASHTO M145 A1 or A-3. Trench per Plans and Section 312000 Earth Moving.
- B. Lay pipe with a minimum of Type 5 bedding per Detail "Standard Pipe Laying Conditions." Installation shall conform to requirements of ASTM D 2321.
- C. Compact stone bedding material and prepare trench per Plans and Section 312000 Earth Moving.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade as detailed in Plans.

3.6 DROP INLET AND MANHOLE INSTALLATION

- A. Construct drop inlets and manholes to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Install per plan details and specifications.

3.7 DRAIN BASIN INSTALLATION

- A. Order drain basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Install per plan details and specifications.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.9 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 - 1. Make branch connections to underground manholes by boring to manhole and, from within manhole, cutting opening into existing unit large enough to allow 2 inches of concrete to be packed around entering connection. Square cut end of connection pipe passing through structure wall to extend not more than 1 inch beyond the inside wall unless otherwise indicated.
 - a. Use non-shrink grout that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - 2. Remove and reform manhole invert to provide a smooth, uniform surface between pipes and manhole invert using non-shrink grout.
 - 3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- A. Connect nonpressure, gravity-flow drainage piping to building roof drains as shown in civil Plans.
- B. Install adapter couplings per Manufacturer's recommendations.

3.10 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with ACI 318.

3.11 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Grout fill abandoned underground piping indicated to remain in place. Use materials and methods strong enough to withstand hydrostatic and earth pressures that may result after the piping has been abandoned.

1. Grout fill piping with pumped cellular concrete or other approved method.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and:
 1. Remove manhole or structure and grout fill remaining piping indicated to be abandoned in place.
- C. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.12 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping.
 1. Use detectable warning tape over nonferrous piping.

3.13 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test and inspect interior of bored piping to determine whether line displacement or other damage has occurred. Inspect after completion of bored pipe and prior to continuation of storm sewer construction.
 1. Submit separate reports for each system inspection.
 2. Additional testing for bored piping includes the following:
 - a. Depth Test: Confirm pipe invert is within 0.1 feet of design every 5 feet.
 - b. Air Tests: Test piping according to ASTM F 1417.
 3. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Depth: Local low spots that collect water and do not provide for positive drainage in direction of flow.
 - d. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - e. Infiltration: Water leakage into piping.
 - f. Exfiltration: Water leakage from or around piping.

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- g. Pressure: Leaks and loss in test pressure constitute defects that must be repaired.
 - 4. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 5. Reinspect and repeat procedure until results are satisfactory.
 - C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to Owner requirements.
 - 3. Schedule tests and inspections with at least 24 hours advance notice to Owner and Engineer.
 - 4. Submit separate report for each test.
 - D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 MATERIAL HANDLING

- A. Prevent damage to pipe. Examine pipes for cracks and other defects, install materials by suitable means, and replace defective or damaged materials.
- B. Lay pipe straight in alignment and gradient. Ensure deflection allowances are not exceeded.

3.15 EXISTING PAVEMENTS

- A. Remove and replace existing pavement per Plans and Section 321373 Concrete Paving.

3.16 CLEANING AND TESTING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.
- B. Test all lines before requesting final acceptance from Owner.

END OF SECTION 334200