

PROJECT MANUAL FOR:

**MEMORIAL STADIUM
NORTH CONCOURSE VIDEO BOARD
REPLACEMENT**

PROJECT NO.: CP241291

AT:

**UNIVERSITY OF MISSOURI - COLUMBIA
COLUMBIA, MISSOURI**

FOR:

**THE CURATORS OF THE
UNIVERSITY OF MISSOURI**

PREPARED BY:



***PLANNING
DESIGN &
CONSTRUCTION***

**CAMPUS FACILITIES
UNIVERSITY OF MISSOURI**

WITH

POPULOUS®

**BID DOCUMENTS
MARCH 22, 2024**

PART 1 - ARCHITECTURAL CERTIFICATION

1.1 CERTIFICATION

- A. I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Specifications are as required by and in compliance with Building Codes of the State of Missouri.
- B. I hereby specify that the documents intended to be authenticated by my seal are limited to:


02 41 19
05 40 00

07 41 13.16
07 42 13.13

10 81 13

1.2 PROFESSIONAL SEAL



A. Signature:  Date: 03/22/2024

THIS IS INTENTIONALLY LEFT BLANK

PART 1 - ELECTRICAL CERTIFICATION

1.1 CERTIFICATION

- A. I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Specifications are as required by and in compliance with Building Codes of the State of Missouri.
- B. I hereby specify that the documents intended to be authenticated by my seal are limited to:

26 00 10	26 05 26	26 05 73
26 05 00	26 05 33	26 24 16
26 05 19	26 05 53	

1.2 PROFESSIONAL SEAL



A. Signature: Andrea Mulvany Date: 03/22/2024

THIS IS INTENTIONALLY LEFT BLANK

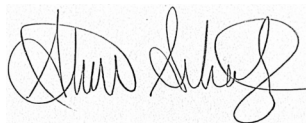
PART 1 - AUDIO-VISUAL CERTIFICATION

1.1 CERTIFICATION

- A. I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Specifications are as required by and in compliance with Building Codes of the State of Missouri.
- B. I hereby specify that the documents intended to be authenticated by my seal are limited to:

27 41 16

1.2 PROFESSIONAL SEAL

A. Signature:  Date: 03/22/2024

THIS IS INTENTIONALLY LEFT BLANK

**MEMORIAL STADIUM
NORTH CONCOURSE VIDEO BOARD REPLACEMENT**

PROJECT NUMBER: CP241291

TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
00 01 05	1
Architectural Certification	1
Electrical Certification	1
Audio-Visual Certification	1
Table of Contents	TOC/1-3
<u>DIVISION 1</u>	<u>GENERAL REQUIREMENTS</u>
	Advertisement for Bids
1.A	1.A/1-6
1.B	BSQ/1-2
1.B.2	SD/1-2
1.B.3	SD/3-4
1.B.4	SD/5
1.B.5	SD/6
1.B.6	SD/7
1.B.7	SD/8
1.B.8	SD/9
1.C	IFB/1-5
1.D	GC/1-39
1.E	SC/1-12
1.E.1	SS/1-4
1.E.4	SDSL/1-3
1.E.5	OMML/1
1.E.6	CLOSL/1

1.F	Index of Drawings	INDEX/1
1.G	Prevailing Wage Rates	PW/1

DIVISION 2 **EXISTING CONDITIONS**

02 41 19	SELECTIVE DEMOLITION	1-6
----------	----------------------	-----

DIVISION 3 *CONCRETE (NOT USED)*

DIVISION 4 *MASONRY (NOT USED)*

DIVISION 5 **METALS**

05 40 00	COLD-FORMED METAL FRAMING (DELEGATED DESIGN)	1-9
----------	--	-----

DIVISION 6 *WOOD AND PLASTICS, AND COMPOSITES (NOT USED)*

DIVISION 7 **THERMAL AND MOISTURE PROTECTION**

07 41 13.16	STANDING-SEAM METAL ROOF PANELS	1-9
07 42 13.13	FORMED METAL WALL PANELS	1-8

DIVISION 8 *OPENINGS (NOT USED)*

DIVISION 9 *FINISHES (NOT USED)*

DIVISION 10 **SPECIALTIES**

10 81 13	BIRD CONTROL DEVICES	1-2
----------	----------------------	-----

DIVISION 11 *EQUIPMENT (NOT USED)*

DIVISION 12 *FURNISHINGS (NOT USED)*

DIVISION 13 *SPECIAL CONSTRUCTION (NOT USED)*

DIVISION 14 *CONVEYING SYSTEMS (NOT USED)*

DIVISION 21 *FIRE SUPPRESSION (NOT USED)*

DIVISION 22 *PLUMBING (NOT USED)*

DIVISION 23 *MECHANICAL (NOT USED)*

DIVISION 25

INTEGRATED AUTOMATION (NOT USED)

DIVISION 26

ELECTRICAL

26 00 10	GENERAL ELECTRICAL REQUIREMENTS	1-18
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	1-7
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	1-6
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	1-8
26 05 33	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS	1-11
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	1-5
26 05 73	LOW-VOLTAGE ELECTRICAL SYSTEM STUDIES	1-6
26 24 16	PANELBOARDS	1-7

DIVISION 27

COMMUNICATIONS

27 41 16	AUDIO VISUAL SYSTEMS	1-40
----------	----------------------	------

DIVISION 28

ELECTRONIC SAFETY AND SECURITY (NOT USED)

DIVISION 31

EARTHWORK (NOT USED)

DIVISION 32

EXTERIOR IMPROVEMENTS (NOT USED)

DIVISION 33

UTILITIES (NOT USED)

DIVISION 34

TRANSPORTATION (NOT USED)

APPENDIX:

E1	ELECTRICAL NARRATIVE	1-5
----	----------------------	-----

END OF SECTION

PLANNING DESIGN & CONSTRUCTION

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

ADVERTISEMENT FOR BIDS

Sealed bids for:

MEMORIAL STADIUM –
NORTH CONCOURSE VIDEO BOARD REPLACEMENT
UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI

PROJECT NUMBER: CP241291

CONSTRUCTION ESTIMATE: \$1,890,000-\$2,100,000

will be received by the Curators of the University of Missouri, Owner, at Planning, Design & Construction, Room L100 (Front Reception Desk), General Services Building, University of Missouri, Columbia, Missouri 65211, until 1:30 p.m., C.T., April 18, 2024 and then immediately opened and publicly read aloud.

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

Questions regarding the scope of work should be directed to Josh Vogel with Populous Architects at (469) 862-0915 or josh.vogel@populous.com. Questions regarding commercial conditions should be directed to Heather Brown at (573) 884-6322 or brownheat@missouri.edu.

A prebid meeting will be held at 1:30 p.m., C.T., April 4, 2024 in the General Services Bldg., Room 194A, followed by a site walk-through.

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

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

Individuals with special needs as addressed by the Americans with Disabilities Act may contact (573) 882-6800.

Advertisement Date: March 27, 2024

SECTION 1.A

BID FOR LUMP SUM CONTRACT

Date: _____

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

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

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

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by Planning, Design, and Construction, entitled "Memorial Stadium – North Concourse Video Board Replacement", project number CP241291, dated March 22, 2024, having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri's tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____

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

3. BID PRICING

a. Base Bid:

The Bidder agrees to furnish all labor, materials, tools, and equipment required to remove the existing field-side video board, scoreboard and ribbon board; removal of existing street-side video board; selective demolition of existing audio system in accordance with new system; selective demolition of existing formed metal wall panels and associated trim. Work shall consist of new structural framing and catwalk at east and west ends of existing structure/catwalk for attachment of and access to new field-side and street-side video boards; modifications to audio system; covering of exposed structure/catwalk with formed metal wall panels matching existing; enclosing top of new structure with standing seam metal roof matching existing and bottom of new catwalk with bird control netting.; all as indicated on the Drawings and described in these Specifications 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 by August 2, 2024. Video board commissioning will begin August 5, 2024. Video board must be fully operational by August 23, 2024.
- 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.

5. SUBCONTRACTOR LIST:

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

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

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

Work to be performed Subcontractor Name, City, and State

Structural Steel _____

Video Board _____

Sound System _____

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

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

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

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

MBE PERCENTAGE PARTICIPATION:
_____ percent (_____%)

WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION
_____ percent (_____%)

SDVE PERCENTAGE PARTICIPATION:
_____ percent (_____%)

- d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS

- a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.
- b. Bidder agrees that bid shall not be withdrawn for a period of ninety (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 a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.
- e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.
- f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

- a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.
- b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.
- c. He has not solicited or induced any person, firm or corporation to refrain from bidding.
- d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.
- e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.
- f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

END OF BIDDER'S CERTIFICATE

9. BIDDER'S SIGNATURE

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

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

Yes _____ No _____

(b) Have you filed all required compliance reports?

Yes _____ No _____

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

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

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

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

12. List banking references.

- 13. (a) Do you have a current confidential financial statement on file with Owner?
Yes _____ No _____ (If not, and if desired, Bidder may submit such statement with bid, in a separate sealed and labeled envelope.)
- (b) If not, upon request will you file a detailed confidential financial statement within three (3) days?
Yes _____ No _____

Dated at _____ this _____ day of _____ 20_____

Name of Organization

Signature

Printed Name

Title of Person Signing

END OF SECTION

SUPPLIER DIVERSITY COMPLIANCE EVALUATION FORM

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

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

I. Project: _____

II. Name of General Contractor: _____

III. Name of Diverse Firm: _____
Address: _____

Phone No.: _____ Fax No.: _____

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

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

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

Alternate(s), (Identify separately): _____

VI. Is the proposed subcontractor listed in the Directory of M/W/DBE Vendors, Directory of Serviced Disabled Veterans and/or the Directory of Veterans maintained by the State of Missouri?
Yes _____ No _____

Is the proposed subcontractor certified as a diverse supplier by any of the following: federal government agencies, state agencies, State of Missouri city or county government agencies, Minority and/or WBE certifying agencies?

Yes _____

No _____

If yes, please provide details and attach a copy of the certification.

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

Yes _____

No _____

If yes, please attach letter.

Signature:

Name:

Title:

Date:

APPLICATION FOR WAIVER

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

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

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

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

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

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

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

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

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

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

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

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

Signature _____

Name _____

Title _____

Company _____

Date _____

AFFIDAVIT

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

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

Signature _____

Name _____

Title _____

Date _____

Corporate Seal (where appropriate)

Date _____

State of _____

County of _____

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

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

(Seal)

Notary Public _____

Commission expires _____

AFFIDAVIT FOR AFFIRMATIVE ACTION

State of Missouri)
)
County of) ss.

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

Subscribed and sworn before me this _____ day of _____, 19_____.

My commission expires _____, 19_____.

CERTIFYING SUPPLIER DIVERSITY AGENCIES

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

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

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

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

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

Lambert St. Louis International Airport
Business Diversity Development Office
11495 Navaid
Bridgeton, MO 63044
P: 314-426-8111
W: www.flystl.com/business/business-diversity-development-1/directories

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

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

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

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

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

State of Missouri OA
Office of Equal Opportunity
301 W. High St. HSC Rm 870-B
Jefferson City, MO 65101
P: 877.259.2963
W: oa.mo.gov/sites/default/files/sdvelisting.pdf
oeo.mo.gov/

Minority Newspapers

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

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

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

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

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

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

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

AFFIDAVIT OF SUPPLIER DIVERSITY PARTICIPATION

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

1. Diverse Firm: _____
 Contact Name: _____
 Address: _____
 Phone No.: _____ E-Mail: _____

Status (check one) MBE WBE Veteran Service Disabled Veteran DBE
 If MBE, Certified as (circle one): 1) Black American 2) Hispanic American 3) Native American 4) Asian American

2. Is the proposed diverse firm certified by an approved agency [see IFB article 15]? Yes No

Agency: _____ [attach copy of certification authorization from agency]

Certification Number: _____

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

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

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

General Contractor: _____ Diverse Firm: _____

Signature: _____ Signature: _____

Name: _____ Name: _____

Title: _____ Title: _____

Date: _____ Date: _____

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

Contractor: _____ Diverse Firm: _____

Signature: _____ Signature: _____

Name: _____ Name: _____

Title: _____ Title: _____

Date: _____ Date: _____

University of Missouri

INFORMATION FOR BIDDERS

Page No.

1. Contract Documents..... FB/1
2. Bidder's Obligation FB/1
3. Interpretation of Documents FB/1
4. Bids FB/1
5. Modification and Withdrawal of Bids..... FB/2
6. Signing of Bids FB/2
7. Bid Security FB/2
8. Bidder's Statement of Qualifications FB/2
9. Award of Contract..... FB/2
10. Contract Execution..... FB/2
11. Contract Security..... FB/3
12. Time of Completion FB/3
13. Number of Contract Documents..... FB/3
14. Missouri Products and Missouri Firms..... FB/3
15. Supplier Diversity FB/3
16. List of Subcontractors FB/5

1. Contract Documents

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

2. Bidder Obligations

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

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

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

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

3. Interpretation of Documents

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

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

3.3 Bids shall be based only on interpretations issued in the form of addenda mailed to each person who is on the

Architect's record as having received a set of the contract documents.

4. Bids

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

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

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

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

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

4.6 No bidder shall stipulate in their bid any conditions not contained in the bid form.

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

5. Modification and Withdrawal of Bids

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

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

6. Signing of Bids

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

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

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

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

7. Bid Security

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

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

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

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

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

8. Bidder's Statement of Qualifications

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

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

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

9. Award of Contract

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

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

10. Contract Execution

10.1 The Contractor shall submit within fifteen (15) days from receipt of notice, the documents required in Article 9 of the General Conditions for Construction Contract included in the contract documents.

10.2 No bids will be considered binding upon the Owner until the documents listed above have been furnished. Failure of Contractor to execute and submit these documents within the time period specified will be treated, at the option of the

Owner, as a breach of the bidder's bid security under Article 7 and the Owner shall be under no further obligation to Bidder.

11. Contract Security

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

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

11.3 If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to conduct business in the State of Missouri is terminated, or it ceases to meet the requirements of this Article 11, Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to Owner. If Contractor fails to make such substitution, Owner may procure such required bonds on behalf of Contractor at Contractor's expense.

12. Time of Completion

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

13. Number of Contract Documents

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

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

14. Missouri Products and Missouri Firms

14.1 The Curators of the University of Missouri have adopted a policy which is binding upon all employees and departments of the University of Missouri, and which by contract, shall be binding upon independent contractors and subcontractors with the University of Missouri whereby all other things being equal, and when the same can be secured without additional cost over foreign products, or products of other states, a preference shall be granted in all construction, repair and purchase contracts, to all products, commodities,

materials, supplies, and articles mined, grown, produced, and manufactured in marketable quantity and quality in the State of Missouri, and to all firms, corporations or individuals doing business as Missouri firms, corporations, or individuals. Each bidder submitting a bid agrees to comply with and be bound by the foregoing policy.

15. SUPPLIER DIVERSITY

15.1 Award of Contract

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

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

15.2 List of Supplier Diversity Firms

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

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

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

15.3 Supplier Diversity Percentage Goal

The bidder shall have a minimum goal of subcontracting with diverse contractors, subcontractors, and suppliers, the percent

of contract price stated in the Supplier Diversity goal paragraph of the Bid for Lump Sum Contract Form.

15.4 Supplier Diversity Percent Goal Computation

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

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

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

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

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

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

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

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

15.5 Certification by Bidder of Diverse Firms

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

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

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

15.6 Supplier Diversity Participation Waiver

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

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

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

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

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

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

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

15.6.2.6 The bidder's efforts to provide interested diverse firms with sufficiently detailed information about the drawings, specific actions and requirements of the contract, and clear scopes of work for the firms to bid on.

15.6.2.7 The bidder's efforts to solicit for specific sub-bids from diverse firms in good faith. Documentation should include names, addresses, and telephone numbers of firms contacted a description of all information provided the diverse firms, and an explanation as to why agreements were not reached.

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

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

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

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

15.7 Submittal of Forms

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

15.8 Additional Bid/Proposer Information

15.8.1 The Contracting Officer reserves the right to request additional information regarding Supplier Diversity participation and supporting documentation from the apparent low bidder. The bidder shall respond in writing to the Contracting Officer within 24 hours (1 workday) of a request.

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

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

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

16. List of Subcontractors

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

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

16.3 Upon award of the contract, the requirements of Article 10 of this document and Article 5 of the General Conditions of the Contract for Construction included in the contract documents will apply.

University of Missouri

General Conditions

of the

Contract

for

Construction

December 2021 Edition

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF ARTICLES

	PAGE
1. GENERAL PROVISIONS.....	GC/1
1.1 Basic Definitions	GC/1
1.2 Specifications and Drawings	GC/3
1.3 Required Provisions Deemed Inserted.....	GC/4
2. OWNER.....	GC/4
2.1 Information and Services Required of the Owner	GC/4
2.2 Owner's Right to Stop the Work.....	GC/4
2.3 Owner's Right to Carry Out the Work	GC/4
2.4 Extent of Owner Rights	GC/5
3. CONTRACTOR	GC/5
3.1 Contractor's Warranty.....	GC/5
3.2 Compliance with Laws, Regulations, Permits, Codes, and Inspections	GC/5
3.3 Anti-Kickback	GC/6
3.4 Supervision and Construction Procedures	GC/6
3.5 Use of Site	GC/7
3.6 Review of Contract Documents and Field Conditions by Contractor.....	GC/8
3.7 Cleaning and Removal.....	GC/8
3.8 Cutting and Patching	GC/8
3.9 Indemnification.....	GC/9
3.10 Patents	GC/9
3.11 Delegated Design.....	GC/10
3.12 Materials, Labor, and Workmanship	GC/10
3.13 Approved Equal.....	GC/11
3.14 Shop Drawings, Product Data and Samples	GC/11
3.15 Record Drawings	GC/12
3.16 Operating Instructions and Service Manual.....	GC/13
3.17 Taxes	GC/13
3.18 Contractor's Construction Schedules.....	GC/14
4. ADMINISTRATION OF THE CONTRACT	GC/14
4.1 Rights of the Owner.....	GC/14
4.2 Rights of the Architect.....	GC/15
4.3 Review of the Work.....	GC/15
4.4 Claims.....	GC/15
4.5 Claims for Concealed or Unknown Conditions	GC/15
4.6 Claim for Additional Cost	GC/16
4.7 Claims for Additional Time.....	GC/16
4.8 Resolution of Claims and Disputes.....	GC/17
4.9 Administrative Review	GC/17
5. SUBCONTRACTORS	GC/17
5.1 Award of Subcontracts	GC/17
5.2 Subcontractual Relations	GC/18
5.3 Contingent Assignment of Subcontract	GC/18
6. SEPARATE CONTRACTS AND COOPERATION	GC/18
7. CHANGES IN THE WORK.....	GC/19
7.1 Change Orders	GC/19
7.2 Construction Change Directive.....	GC/20
7.3 Overhead and Profit.....	GC/20
7.4 Extended General Conditions	GC/21
7.5 Emergency Work.....	GC/21

8. TIME	GC/21
8.1 Progress and Completion.....	GC/21
8.2 Delay in Completion.....	GC/21
8.3 Liquidated Damages.....	GC/22
9. PAYMENTS AND COMPLETION.....	GC/22
9.1 Commencement, Prosecution and Completion.....	GC/22
9.2 Contract Sum	GC/23
9.3 Schedule of Values	GC/24
9.4 Applications for Payment	GC/24
9.5 Approval for Payment	GC/25
9.6 Decisions to Withhold Approval	GC/25
9.7 Progress Payments.....	GC/25
9.8 Failure of Payment.....	GC/26
9.9 Substantial Completion.....	GC/26
9.10 Partial Occupancy or Use	GC/26
9.11 Final Completion and Final Payment	GC/26
10. PROTECTION OF PERSONS AND PROPERTY	GC/27
10.1 Safety Precautions and Programs	GC/27
10.2 Safety of Persons and Property.....	GC/27
11. INSURANCE & BONDS	GC/28
11.1 Insurance.....	GC/28
11.2 Commercial General Liability	GC/28
11.3 Licensed for Use Vehicle Liability.....	GC/29
11.4 Workers' Compensation Insurance.....	GC/29
11.5 Liability Insurance General Requirements	GC/29
11.6 Builder's Risk Insurance	GC/30
11.7 Bonds.....	GC/31
12. UNCOVERING AND CORRECTION OF THE WORK.....	GC/32
12.1 Uncovering of the Work	GC/32
12.2 Correction of the Work.....	GC/32
12.3 Acceptance of Nonconforming Work.....	GC/32
13. MISCELLANEOUS PROVISIONS	GC/33
13.1 Written Notice	GC/33
13.2 Rights and Remedies	GC/33
13.3 Tests and Inspections.....	GC/33
13.4 Nondiscrimination in Employment Equal Opportunity	GC/33
13.5 Supplier Diversity Goal Program	GC/34
13.6 Wage Rates.....	GC/34
13.7 Records.....	GC/36
13.8 Codes and Standards.....	GC/36
13.9 General Provisions.....	GC/37
13.10 Certification.....	GC/37
14. TERMINATION OR SUSPENSION OF THE CONTRACT	GC/38
14.1 Termination by Owner for Cause	GC/38
14.2 Suspension by the Owner for Convenience	GC/38
14.3 Owner's Termination for Convenience	GC/38

ARTICLE 1 GENERAL PROVISIONS

1.1 Basic Definitions

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

1.1.1 Owner

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

1.1.2 Contracting Officer

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

1.1.3 Owner's Representative

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

1.1.4 Architect

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

1.1.5 Owner's Authorized Agent

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

1.1.6 Contractor

The Contractor is the person or entity with whom the Owner has entered into the Contract for Construction. The term "Contractor" means the Contractor or the Contractor's authorized representative.

1.1.7 Subcontractor and Lower-tier Subcontractor

A Subcontractor is a person or organization who has a contract with the Contractor to perform any of the Work. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or its authorized representative. The term "Subcontractor" also is applicable to those furnishing materials to be incorporated in the Work whether work performed is at the Owner's site or off site, or both. A lower-tier Subcontractor is a person or organization who has a contract with a Subcontractor or another lower-tier

Subcontractor to perform any of the Work at the site. Nothing contained in the Contract Documents shall create contractual relationships between the Owner or the Architect and any Subcontractor or lower-tier Subcontractor of any tier.

1.1.8 Supplier Diversity Definitions

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

.1 Minority Business Enterprises (MBE)

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

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

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

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

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

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

.2 Women Business Enterprise (WBE)

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

.3 Veteran Owned Business

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

.4 Service-Disabled Veteran Enterprise (SDVE)

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

.5 Disadvantaged Business Enterprise (DBE)

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

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

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

1.1.9 Work

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

1.1.10 Approved

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

1.1.11 Contract Documents

The Contract Documents consist of (1) the executed Contract for Construction, (2) these General Conditions of

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

1.1.12 Contract

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

1.1.13 Change Order

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

1.1.14 Substantial Completion

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

1.1.15 Final Completion

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

1.1.16 Supplemental and Special Conditions

The terms "Supplemental Conditions" or "Special Conditions" shall mean the part of the Contract Documents

which amend, supplement, delete from, or add to these General Conditions.

1.1.17 Day

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

1.1.18 Knowledge.

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

1.1.19 Punch List

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

1.1.20 Public Works Contracting Minimum Wage

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

1.1.21 Force Majeure

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

1.2 Specifications and Drawings

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

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

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

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

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

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

1.2.7 Only work included in the Contract Documents is authorized, and the Contractor shall do no work other than that described therein.

1.2.8 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be

performed and correlated personal observations with requirements of the Contract Documents. Contractor represents that it has performed its own investigation and examination of the Work site and its surroundings and satisfied itself before entering into this Contract as to:

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

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

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

1.3 Required Provisions Deemed Inserted

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

ARTICLE 2 OWNER

2.1 Information and Services Required of Owner

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

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

2.2 Owner's Right to Stop the Work

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

2.3 Owner's Right to Carry Out the Work

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

2.3.2 In the event the Contractor has not satisfactorily completed all items on the Punch List within thirty (30) days of its receipt, the Owner reserves the right to complete the Punch List without further notice to the Contractor or its surety. In such case, Owner shall be entitled to deduct from payments then or thereafter due the Contractor the cost of completing the Punch List items, including compensation for the Architect's additional services. If payments then or

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

2.4 Extent of Owner Rights

2.4.1 The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

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

ARTICLE 3 CONTRACTOR

3.1 Contractor's Warranty

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

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

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

3.1.4 Neither the final payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner, nor expiration of warranty stated herein, will constitute an acceptance of Work not

done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any responsibility for non-conforming work. The Contractor shall immediately remedy any defects in the Work and pay for any damage to other Work resulting therefrom upon written notice from the Owner. Should the Contractor fail or refuse to remedy the non-conforming work, the Owner may perform, or cause to be performed the work necessary to bring the work into conformance with the Contract Documents at the Contractor's expense.

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

3.2 Compliance with Laws, Regulations, Permits, Codes, and Inspections

3.2.1 The Contractor shall, without additional expense to the Owner, comply with all applicable laws, ordinances, rules, permit requirements, codes, statutes, and regulations (collectively referred to as "Laws").

3.2.2 Since the Owner is an instrumentality of the State of Missouri, municipal, or political subdivision, ordinances, zoning ordinances, and other like ordinances are not applicable to construction on the Owner's property, and the Contractor will not be required to submit plans and specifications to any municipal or political subdivision authority to obtain construction permits or any other licenses or permits from or submit to, inspection by any municipality or political subdivision relating to the construction on the Owner's property, unless required by the Owner in these Contract Documents or otherwise in writing.

3.2.3 All fees, permits, inspections, or licenses required by municipality or political subdivision for operation on property not belonging to the Owner, shall be obtained by and paid for by the Contractor. The Contractor, of its own expense, is responsible to ensure that all inspections required by said permits or licenses on property, easements, or utilities not belonging to the Owner are conducted as required therein. All connection charges, assessments or transportation fees as may be imposed by any utility company or others are

included in the Contract Sum and shall be the Contractor's responsibility, as stated in 2.1.1 above.

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

3.3 Anti-Kickback

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

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

3.4 Supervision and Construction Procedures

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

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

3.4.3 The Contractor and each of its Subcontractors of any tier shall submit to the Owner such schedules of quantities and costs, progress schedules in accordance

with 3.17.2 of this document, payrolls, reports, estimates, records, and other data as the Owner may request concerning Work performed or to be performed under the Contract.

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

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

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

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

- .1** All shutting of valves, switches, etc., shall be by the Owner's personnel.
- .2** Contractor shall submit its preliminary outage/tie-in schedule with its baseline schedule.
- .3** The Contractor shall request an outage/tie-in meeting at least two weeks before the outage/tie-in is required.
- .4** The Owner's Representative will schedule an outage/tie-in meeting at least one week prior to the outage/tie-in.

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

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

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

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

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

3.4.12 During the performance of the Work, the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences, and other devices appropriately located on site which shall give proper and understandable warning to all persons of danger of entry onto land, structure, or equipment, within the limits of the Contractor's work area.

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

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

3.4.15 When requested by the Owner's Representative, the Contractor, at no extra charge, shall provide scaffolds

or ladders in place as may be required by the Architect or the Owner for examination or inspection of Work in progress or completed.

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

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

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

3.5 Use of Site

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

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

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

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

comprising the Work or to the owner or occupant of any adjacent land or areas resulting from the performance of the Work.

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

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

3.6 Review of Contract Documents and Field Conditions by Contractor

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

3.6.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported in writing to the Architect and Owner's Representative within twenty-four (24) hours. During the progress of work, Contractor shall verify all field measurements prior to fabrication of building components or equipment and proceed with the fabrication to meet field conditions. Contractor shall consult all Contract Documents to determine the exact location of all work and verify spatial relationships of all work. Any question concerning said

location or spatial relationships shall be submitted to the Owner's Representative. Specific locations for equipment, pipelines, ductwork and other such items of work, where not dimensioned on plans, shall be determined in consultation with Owner's Representative and Architect. Contractor shall be responsible for the proper fitting of the Work in place.

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

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

3.7 Cleaning and Removal

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

3.8 Cutting and Patching

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

3.8.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter

such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

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

3.9 Indemnification

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

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

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

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

3.10 Patents

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

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

such infringement at any time during the prosecution of the Work or after completion of the Work.

3.11 Delegated Design

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

3.12 Materials, Labor, and Workmanship

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

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

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

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

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

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

3.12.7 Unless otherwise specifically noted, the Contractor shall provide and pay for supervision, labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

facilities and services necessary for the proper execution and completion of the Work.

3.12.8 Substitutions

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

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

- .1** Full explanation of the proposed substitution and submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation of the substitution.
- .2** Reasons the substitution is advantageous and necessary, including the benefits to the Owner and the Work in the event the substitution is acceptable.
- .3** The adjustment, if any, in the Contract Sum, in the event the substitution is acceptable.
- .4** The adjustment, if any, in the time of completion of the Contract and the construction schedule in the event the substitution is acceptable.
- .5** An affidavit stating that (a) the proposed substitution conforms to and meets all of the Contract Document requirements and is code compliant, except as specifically disclosed and set forth in the affidavit and (b) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect. Proposals for substitutions shall be submitted to the Architect and Owner's Representative in sufficient time to allow the Architect and Owner's Representative no less than ten (10) working days for review. No substitution will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated herein.

3.12.8.3 Substitutions may be rejected without explanation at the Owner's sole discretion and will be considered only under one or more of the following conditions:

- .1** Required for compliance with interpretation of code requirements or insurance regulations then existing;
- .2** Unavailability of specified products, through no fault of the Contractor;
- .3** Material delivered fails to comply with the Contract Documents;
- .4** Subsequent information discloses inability of specified products to perform properly or to fit in designated space;

- .5 Manufacturer/fabricator refuses to certify or guarantee performance of specified product as required; or
- .6 When in the judgment of the Owner or the Architect, a substitution would be substantially to the Owner's best interests, in terms of cost, time, or other considerations.

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

3.13 Approved Equal

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

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

3.13.3 No approvals or action taken by the Architect or Owner's Representative shall relieve Contractor from its obligation to ensure that an "or equal" article, appliance, device, or material strictly complies with the requirements of the Contract Documents. Contractor shall not propose "or equal" items in connection with Shop Drawings or

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

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

3.14.1 Shop Drawings are drawings, diagrams, schedules, and other data specifically prepared for the Work by the Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

3.14.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

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

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

3.14.5 Shop Drawings, Coordination Drawings/BIM Models, Product Data, Samples and similar submittals (collectively referred to as "Submittals") are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are

required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

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

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

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

3.14.9 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents such Submittals strictly comply with the requirements of the Contract Documents and that the

Contractor has determined and verified field measurements and field construction criteria related thereto, that materials are fit for their intended use and that the fabrication, shipping, handling, storage, assembly and installation of all materials, systems and equipment are in accordance with best practices in the industry and are in strict compliance with any applicable requirements of the Contract Documents. Contractor shall also coordinate each Submittal with other Submittals.

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

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

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

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

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

3.15 Record Drawings

3.15.1 The Contractor shall maintain a set of Record Drawings on site in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (1) bidding addendums, (2) executed change orders, (3) deviations from the Drawings made during construction; (4) details in the Work not previously shown; (5) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (6) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access

panels, control valves, drains, openings, and stub-outs; and (7) such other information as either Owner or Architect may reasonably request. The prints for Record Drawing use will be a set of "blue line" prints provided by Architect to Contractor at the start of construction. Upon Substantial Completion of the Work, Contractor shall deliver all Record Drawings to Owner and Architect for approval. If not approved, Contractor shall make the revisions requested by Architect or Owner's Representative. Final payment and any retainage shall not be due and owing to Contractor until the final Record Drawings marked by Contractor as required above are delivered to Owner.

3.16 Operating Instructions and Service Manuals

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

- .1** Start-up and Shutdown Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available, they may be incorporated into the operating manual for reference.
- .2** Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
- .3** Equipment List: List of all major equipment as installed shall include model number, capacities, flow rate, and name-plate data.
- .4** Service Instructions: The Contractor shall be required to provide the following information for all pieces of equipment.
 - (a)** Recommended spare parts including catalog number and name of local suppliers or factory representative.
 - (b)** Belt sizes, types, and lengths.
 - (c)** Wiring diagrams.
- .5** Manufacturer's Certificate of Warranty: Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year from the date of Substantial Completion. Where longer period is required by the Contract Documents, the longer period shall govern.
- .6** Parts catalogs: For each piece of equipment furnished, a parts catalog or similar document shall be provided which identifies the components by number for replacement ordering.

3.16.2 Submission

- .1** Manuals shall be bound into volumes of standard 8 1/2" x 11" hard binders. Large drawings too bulky to be folded into 8 1/2" x 11" shall be separately bound or folded and in brown

envelopes, cross-referenced and indexed with the manuals.

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

3.17 Taxes

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

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

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

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

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

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

3.18 Contractor's Construction Schedules

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

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

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

- .1** The schedule shall be prepared using Primavera P3, Oracle P6, Microsoft Project or other software acceptable to the Owner's Representative.
- .2** The schedule shall be prepared and maintained in CPM format, in accordance with Construction CPM Scheduling, published by the Associated General Contractors of American (AGC).
- .3** Prior to submittal to the Owner's Representative for review, Contractor shall obtain full buy-in to the schedule from all major subcontractors, in writing if so, requested by Owner's Representative.
- .4** Schedule shall be updated, in accordance with Construction CPM Scheduling, published by the AGC, on a monthly basis at minimum, prior to, and submitted with, the monthly pay application or as requested by the Owner's Representative.
- .5** Along with the update the Contractor shall submit a narrative report addressing all changes, delays and impacts, including weather to the schedule

during the last month, and explain how the end date has been impacted by same.

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

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

3.18.4 In the event the Owner's Representative or Architect determines that the performance of the Work, as of a Milestone Date, has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, facilities, (3) expediting delivery of materials, and (4) other similar measures (hereinafter referred to collectively as Extraordinary Measures). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule. The Contractor shall not be entitled to an adjustment in the Contract Sum concerning Extraordinary Measures required by the Owner under or pursuant to this Paragraph 3.17.3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph 3.17.3 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.

ARTICLE 4

ADMINISTRATION OF THE CONTRACT

4.1 Rights of the Owner

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

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

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

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

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

4.1.6 The Owner does not allow smoking on university property.

4.2 Rights of the Architect

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

4.3 Review of the Work

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

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

4.3.3 The fact that the Architect or the Owner's Representative observed, or failed to observe, faulty Work, or Work done which is not in accordance with the Contract Documents, regardless of whether or not the Owner has released final payment, shall not relieve the

Contractor from responsibility for all damages and additional costs of the Owner as a result of defective or faulty Work.

4.4 Claims

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

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

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

4.5 Claims for Concealed or Unknown Conditions

4.5.1 If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Owner's Representative promptly before conditions are disturbed, and in no event later than three (3) days after first observance of the conditions. The Owner's Representative will promptly investigate such conditions. If such conditions differ materially, as provided for above and cause an increase or decrease in the Contractor's cost, or time, required for performance of the Work, an equitable adjustment in the Contract sum or Contract Time, or both, shall be made, subject to the provisions and restrictions set for herein. If the Owner's Representative determines that the

conditions at the site are not materially different from those indicated in the Contract Documents, and that no change in the terms of the Contract is justified, the Owner's Representative will so notify the Contractor in writing. If the Contractor disputes the finding of the Owner's Representative that no change in the terms of the Contract terms is justified, Contractor shall proceed with the Work, taking whatever steps are necessary to overcome or correct such conditions so that Contractor can proceed in a timely manner. The Contractor may have the right to file a Claim in accordance with the Contract Documents.

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

4.6 Claim for Additional Cost

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

4.7 Claims for Additional Time

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

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

4.7.2 If weather days are the basis for a Claim for additional time, such Claim shall be documented by the Contractor by data acceptable to the Owner's Representative substantiating that weather conditions for the period of time in question, had an adverse effect on the critical path of the scheduled construction. Weather days shall be defined as days on which critical path work cannot proceed due to weather conditions (including but not limited to rain, snow, etc.), in excess of the number of days shown on the Anticipated Weather Day schedule in the Special Conditions. To be considered a weather day,

at least four working hours must be lost due to the weather conditions on a critical path scope item for that day.-Weather days and Anticipated weather days listed in the Special Conditions shall only apply to Monday through Friday. A weather day claim cannot be made for Saturdays, Sundays, New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving Day and Christmas Day, unless that specific day was approved in writing for work by the Owner's Representative.

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

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

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

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

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

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

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

4.8 Resolution of Claims and Disputes

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

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

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

4.9 Administrative Review

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

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

appropriate documentation will be signed by the parties to resolve the Claim.

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

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

ARTICLE 5 SUBCONTRACTORS

5.1 Award of Subcontracts

5.1.1 Pursuant to Article 9, the Contractor shall furnish the Owner and the Architect, in writing, with the name, and trade for each Subcontractor and the names of all persons or entities proposed as manufacturers of products, materials and equipment identified in the Contract Documents and where applicable, the name of the installing contractor. The

Owner's Representative will reply to the Contractor in writing if the Owner has reasonable objection to any such proposed person or entity. The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection.

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

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

5.2 Subcontractual Relations

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

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

forms to be signed by any Subcontractors of any tier or suppliers, Contractor shall obtain the same.

5.3 Contingent Assignment of Subcontract

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

ARTICLE 6 SEPARATE CONTRACTS AND COOPERATION

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

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

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

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

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

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

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

ARTICLE 7 CHANGES IN THE WORK

7.1 CHANGE ORDERS

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

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

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

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

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

- .1** By a lump sum proposal from the Contractor and the Subcontractors of any tier, including overhead and profit.
- .2** By a time and material basis with or without a specified maximum. The Contractor shall submit to the Owner's Representative itemized time and material sheets depicting labor, materials, equipment utilized in completing the Work on a daily basis for the Owner's Representative approval. If this pricing option is utilized, the Contractor may be required to submit weekly reports summarizing costs to

date on time and material change orders not yet finalized.

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

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

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

- .1** Labor: The Contractor's proposal shall include breakdowns by labor, by trade, indicating number of hours and cost per hour for each Subcontractor as applicable. Such breakdowns shall only include employees in the direct employ of Contractor or Subcontractors in the performance of the Work. Such employees shall only include laborers at the site, mechanics, craftsmen and foremen. Payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor or Subcontractors. Any item or expense outside of these categories is not allowed. The expense of performing Work after regular working hours, on Saturdays, Sundays or legal holidays shall not be included in the above, unless approved in writing and in advance by Owner.
- .2** Material, supplies, consumables and equipment to be incorporated into the Work at actual invoice cost to the Contractor or Subcontractors; breakdowns showing all material, installed equipment and consumables fully itemized with number of units installed and cost per unit extended. Any singular item or items in aggregate greater than one thousand dollars (\$1,000) in cost shall be supported with supplier invoices at the request of the Owner's Representative. Normal hand tools are not compensable.
- .3** Equipment: Breakdown for required equipment shall itemize (at a minimum) delivery / pick-up charge, hourly

rate and hours used. Operator hours and rate shall not be included in the equipment breakdown. Contractor must use the most cost-effective equipment available in the area and should not exceed the rates listed in the Rental Rate Blue Book for Construction Equipment (Blue Book). Contractor shall submit documentation for the Blue Book to support the rate being requested.

7.2 Construction Change Directive

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

- .1** A lump sum agreement, properly itemized and supported by substantiating documents of sufficient detail to allow evaluation.
- .2** By unit prices contained in the Contractor's original proposal and incorporated in the Construction Contract or subsequently agreed upon.
- .3** A method agreed to by both the Owner and the contractor with a mutually agreeable fee for overhead and profit.
- .4** In the absence of an agreement between the Owner and the Contractor on the method of establishing an adjustment of the contract amount, the Owner, with the assistance of the architect, shall determine the adjustment amount on the basis of expenditures by the Contractor for labor, materials, equipment, and other costs consistent with other provisions of the Contract. The contractor shall keep and submit to the Owner an itemized accounting of all cost components, either expended or saved, while performing the Work covered under the Construction Change Directive.

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

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

7.3 Overhead and Profit

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

- .1** The overhead and profit charged by the Contractor and Subcontractors shall be considered to include, but not limited to, job site office and clerical expense, normal hand tools, incidental job supervision, field supervision, payroll costs and other compensation for project manager, officers, executives, principals, general managers, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, time-keepers, and other personnel employed whether at the site or in principal or a branch office for general superintendent and administration of the Work.
- .2** The percentages for overhead and profit charged on Change Orders shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved but in no case shall exceed the following:
 - 15% To the Contractor or the Subcontractor of any tier for Work performed with their respective forces or materials purchased
 - 5% To the Contractor on Work performed by other than his forces
 - 5% To first tier Subcontractor on Work performed by his Subcontractor
- .3** The Contractor will be allowed to add 2% for the cost of bonding and insurance to their cost of work. This 2% shall be allowed on the total cost of the added work, including overhead and profit.
- .4** Not more than three mark-ups, not to exceed individual maximums shown above, shall be allowed regardless of the number of tier subcontractors. Overhead and profit shall be shown separately for each subcontractor of any tier and the Contractor.
- .5** On proposals covering both increases and decreases in the amount of the Contract, the application of overhead and profit shall be on the net change in direct cost for the Contractor or Subcontractor of any tier performing the Work.
- .6** The percentages for overhead and profit credit to the Owner on Change Orders that are strictly decreases in the quantity of work or materials shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved, but shall not be less than the following:

Overhead and Profit

 - 7.5% Credit to the Owner from the Contractor or Subcontractor of any tier for Work performed with their respective forces or materials purchased
 - 2.5% Credit to the Owner from the Contractor on Work performed by other than his forces
 - 2.5% Credit to the Owner from the first tier Subcontractor on Work performed by his Subcontractor of any tier

7.4 Extended General Conditions

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

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

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

- .1** For the portion of the direct payroll cost of the Contractor's project manager expended in completing the Work and the direct payroll cost of other onsite administrative staff not included in Article 7.3.1. Direct payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor;
- .2** Cost of Contractor's temporary office, including temporary office utilities expense;
- .3** Cost of temporary utilities required in the performance of the work;
- .4** Profit not to exceed 5% of the total extended overhead direct costs;

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

7.5 Emergency Work

7.5.1 If, during the course of the Work, the Owner has need to engage the Contractor in emergency work, whether related to the Work or not, the Contractor shall immediately proceed with the emergency work as directed by the Owner under the applicable provisions of the contract. In so doing, Contractor agrees that all provisions of the contract remain in full force and effect and the schedule for the Work is not impacted in any way unless explicitly agreed to in writing by the Owner.

ARTICLE 8 TIME

8.1 Progress and Completion

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

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

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

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

8.2 Delay in Completion

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

8.2.2 All time limits stated in the Contract are of the essence of the Contract. However, if the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or by the Owner's Representative, by changes ordered in the Work, Force Majeure including but not limited to war, armed conflict, riot, civil commotion or disorder, act of terrorism or sabotage; epidemic, pandemic, outbreaks of infectious disease or any other public health crisis, including quarantine or other employee restrictions, compliance with any law or governmental order, rule, regulation or direction, curfew restriction, act of God or natural disaster such as earthquake, volcanic activity, landslide, tidal wave, tsunami, flood, damage or destruction by lightning, drought; explosion, fire, destruction of machines, equipment, prolonged break-down of transport, telecommunication or electric current; general labor disturbance such as but not limited to boycott, strike and lock-out, occupation of factories and premises, or any other causes beyond the Contractor's reasonable control which the Owner's Representative determines may justify

delay then, upon submission of the Time Impact Schedule Analysis (TIA) justifying the delay called out in Section 4.7 of these General Conditions, the Contract Time may be extended for a reasonable time to the extent such delay will prevent Contractor from achieving Substantial Completion and/or Final Completion within the Contract Time and if performance of the Work is not, was not or would not have been delayed by any other cause for which the Contractor is not entitled to an extension of the Contract Time under the Contract Documents. It shall be a condition precedent to any adjustment of the Contract Time that Contractor provide the Owner's Representative with written notice of the cause of delay within seven (7) days from the occurrence of the event or condition which caused the claimed delay. If a Force Majeure is approved by the Owner as the basis for a delay claim, an adjustment in the contract time to the extent the Force Majeure impacts the schedule is the only remedy. No increase in the contract sum for any reason shall be allowed due to a Force Majeure.

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

8.2.4 Notwithstanding anything to the contrary in the Contract Documents, except as otherwise noted in these General Conditions, an extension in the Contract Time, to the extent permitted under this Article, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity, or (4) other claims due to or caused by any events beyond the control of both the Owner and Contractor defined herein as Force Majeure. In no event shall the Contractor be entitled to any compensation or recovery of any damages or any portion of damages resulting from delays caused by or within the control of Contractor or by acts or omissions of Contractor or its Subcontractors of any tier or delays beyond the control of both Owner and Contractor. If the Contractor contends that delay, hindrance, obstruction or other adverse condition results from acts or omissions of the Owner, the Owner's Representative or the Architect, Contractor shall provide written notice to the Owner within seven (7) calendar days of the event giving rise to such claim. Contractor shall only be entitled to an adjustment in the Contract Sum to the extent that such acts or omissions continue after the Contractor's written notice to the Owner of such acts or omissions, but in no case shall Force Majeure be the basis of an increase in the Contract sum. The Owner's exercise of any of its rights or remedies under the Contract

Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work) regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be the basis of any Claim for an increase in the Contract Sum or Contract Time. In the event Contractor is entitled to an adjustment in the Contract Sum for any delay, hindrance, obstruction or other adverse condition caused by the acts or omissions of the Owner, the Owner's Representative or the Architect, Contractor shall only be entitled to its actual direct costs caused thereby and Contractor shall not be entitled to and waives any right to special, indirect, or consequential damages including loss of profits, loss of savings or revenues, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar type of damages.

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

8.3 Liquidated Damages

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 Commencement, Prosecution, and Completion

9.1.1 The Contractor shall commence Work within five (5) days upon the date of a "Notice to Proceed" from the Owner or the date fixed in the Notice to Proceed. Contractor shall prosecute the Work with faithfulness and diligence, and the

Contractor shall complete the Work within the Contract Time set forth in the Contract Documents.

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

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

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

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

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

9.1.6 Any successful bidder which is a corporation organized in a state other than Missouri or any bidder doing business in the State of Missouri under a fictitious name shall furnish, at no cost to the Owner, no later than the time at which the executed Contract for Construction, the Payment Bond, and the Performance Bond are returned, a properly certified copy of its current Certificate of Authority and License to do business in the State of Missouri. No contract will be executed by the

Owner until such certificate is furnished by the bidder, unless there already is on file with the Owner a current certificate, in which event, no additional certificate will be required during the period of time for which such current certificate remains in effect.

9.1.7 Within fifteen (15) calendar days of the issuance of a Notice to Proceed, the Contractor shall submit one (1) signed copy of the following instruments. No payment will be processed until all of these instruments are received and approved by the Owner's Representative.

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

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

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

9.2 Contract Sum

9.2.1 The Owner shall compensate Contractor for all Work described herein, and in the Contract Documents the Contract

Sum set forth in the Contract for Construction, subject to additions and deletions as provided hereunder.

9.3 Schedule of Values

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

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

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

9.4 Applications for Payment

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

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

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

9.4.4 If approved in writing and in advance by Owner, progress payments may be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. Owner may in its sole discretion refuse to grant approval for payments for materials and equipment stored at the Project site but not yet incorporated in the Work. Any approval by Owner for payment for materials and equipment delivered and suitably stored at the site, or stored offsite as noted below,

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

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

- .1 Items considered to be major items of considerable magnitude, if suitably stored, may be allowed in project pay requests on the basis of ninety percent (90%) of invoices
- .2 Determination of acceptable "major items of considerable magnitude" and "suitably stored" shall be made by the Owner's Representative.
- .3 Aggregate quantities of materials not considered unique to this project will not be considered for offsite storage payment.
- .4 Contractor shall submit to the Owner's Representative a list of the material for which application for payment for offsite storage is anticipated no less than forty-five days prior to the submission of the applicable pay request. The list shall include a material description, applicable division, quantity, and discounts offered to the Owner for early payment. Contractor shall also submit the location the material will be stored and the method of protection
- .5 The storage facility shall be subject to approval by the Owner's representative, shall be located within an acceptable distance of the project sites as established by the Owner's Representative and all materials for the Owner's project must be stored separately from all other items within the storage facility and shall be labeled and stored in the name of The Curators of the University of Missouri.
- .6 The Owner's representative shall be provided a minimum of two weeks' notice to visit the storage facility and inspect the stored material prior to submission of the pay request.
- .7 Upon favorable inspection by the Owner's Representative, the Contractor shall, at the Owner's option, submit a Bill of Sale and Bailment Agreement on forms provided by the Owner's

Representative, transferring title of the material or equipment to The Curators of the University of Missouri.

- .8 An invoice provided by the supplier shall be included with the applicable pay request.
- .9 The contractor shall remain fully responsible for all items, until acceptance of the project by the Owner.
- .10 The contractor shall reimburse all costs incurred by the Owner in inspecting and verifying all material stored offsite, including mileage, airfare, meals, lodging and time, charged at a reasonable hourly rate.
- .11 The Contractor shall furnish and maintain insurance covering the replacement cost of the material stored offsite against all losses and shall furnish proof of coverage with the application for payment for material stored offsite.
- .12 The Contractor is responsible for all costs related to storage and handling of material stored offsite unless otherwise directed by the Owner's Representative.

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

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

9.5 Approval for Payment

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

9.6 Decisions to Withhold Approval

9.6.1 The Owner's Representative may decide not to certify payment and may withhold approval in whole or in part, to the extent reasonably necessary to protect the Owner. If the Owner's Representative is unable to approve payment in the amount of the Application, the Owner's Representative will notify the Contractor as provided in Paragraph 9.5.1. If the Contractor and Owner's Representative cannot agree on a revised amount, the

Owner's Representative will promptly issue approval for payment for the amount for which the Owner's Representative is able to determine is due Contractor. The Owner's Representative may also decide not to approve payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of approval for payment previously issued, to such extent as may be necessary in the Owner's Representative opinion to protect the Owner from loss because of:

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

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

9.7 Progress Payments

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

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

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

9.7.4 Based on the Schedule of Values submitted by Contractor, Applications for Payment submitted by Contractor

shall indicate the actual percentage of completion of each portion of Contractor's Work as of the end of the period covered by the Application for Payment.

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

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

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

9.8 Failure of Payment

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

9.9 Substantial Completion

9.9.1 Substantial Completion is the stage in the progress of the Work as defined in Paragraph 1.1.14 as certified by the Owner.

9.9.2 When the Contractor considers the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Owner and the Architect. The Owner's

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

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

9.10 Partial Occupancy or Use

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

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

9.11 Final Completion and Final Payment

9.11.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Owner's Representative and the Architect will promptly make such inspection and, when the Owner's Representative and Architect find the Work acceptable under the Contract Documents and the Contract fully performed, the Owner's Representative will promptly issue a final approval for payment; otherwise, Owner's

Representative will return Contractor's Final Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Submission of a Final Application for Payment shall constitute a further representation that conditions listed in Paragraph 9.11.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Owner's Representative as part of the final Application for Payment. The final approval for payment will not be issued by the Owner's Representative until all warranties and guarantees have been received and accepted by the Owner.

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

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

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

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

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

ARTICLE 10

PROTECTION OF PERSONS AND PROPERTY

10.1 Safety Precautions and Programs

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

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

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

10.2 Safety Of Persons and Property

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

- .1** students, faculty, staff, the public, construction personnel, and other persons who may be affected thereby;
- .2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
- .3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

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

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

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

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

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

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.2.8 The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with

the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.

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

ARTICLE 11 INSURANCE & BONDS

11.1 Insurance

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

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

11.2 Commercial General Liability

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

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

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

insurance shall cover the Contractor's indemnity obligations contained in the Contract Documents.

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

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

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

11.3 Licensed for Use Vehicle Liability

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

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

11.4 Workers' Compensation Insurance

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

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

11.5 Liability Insurance General/Other Requirements

11.5.1 Any Consultant/Contractor providing professional design services as part of the contract shall be required to provide and maintain, from the date of this Contract and for a period of ten (10) years after the date of Final Completion, Professional Liability insurance to cover any claims, including but not limited to errors, omissions, and negligence, which may arise from the Design and related Services performed by the Consultant. The minimum limits for such Policy shall be \$1,000,000.00 per occurrence/\$1,000,000.00 aggregate. The insurance afforded by the policy shall meet the requirements of this Section 11.2 and Section 11.5 relating to CGL Policies, and without limiting the foregoing, shall be extended to cover the liability of "The officers, employees, and agents of The Curators of the University of Missouri", who shall be named as additional insureds therein, and this liability is assumed in writing by the Contractor's Consultant under the written Subcontract described herein. All insurance coverages procured by Contractor shall be provided by agencies and insurance companies acceptable to and approved by Owner. Any insurance coverage shall be provided by insurance companies that are duly licensed to conduct business in the State of Missouri as an admitted carrier. The form and content of all insurance coverage provided by Contractor are subject to the approval of Owner. All required insurance coverages shall be obtained and paid for by Contractor. Any approval of the form, content or insurance company by Owner shall not relieve the Contractor from the obligation to provide the coverages required herein.

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

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

except for Workers' Compensation, against the Owner and its officers, employees and agents.

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

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

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

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

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

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

11.5.10 By requiring the insurance set forth herein and in the Contract Documents, Owner does not represent or warrant that coverage and limits will necessarily be adequate to protect Contractor, and such coverages and

limits shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

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

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

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

11.6 Builder's Risk Insurance

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

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

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

11.6.4 The insurance required herein shall be on an all risk form and shall be written to cover all risks of physical loss or damage to the insured party and shall insure at least against the perils of fire and extended coverage, theft, vandalism,

malicious mischief, collapse, lightening, earthquake, flood, frost, water damage, windstorm and freezing.

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

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

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

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

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

11.7 Bonds

11.7.1 When the Contract sum exceeds Fifty Thousand Dollars (\$50,000), the Contractor shall procure and

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

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

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

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

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

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

ARTICLE 12
UNCOVERING AND CORRECTION OF THE
WORK

12.1 Uncovering of the Work

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

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

12.2 Correction of the Work

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

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

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

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

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

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

12.3 Acceptance of Nonconforming Work

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

ARTICLE 13
MISCELLANEOUS PROVISIONS

13.1 Written Notice

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

13.2 Rights and Remedies

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

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

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

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

13.3 Tests and Inspections

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

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

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

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

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

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

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

13.4 Nondiscrimination in Employment Equal Opportunity

13.4.1 The University serves from time to time as a contractor for the United States government. Accordingly, the provider of goods and/or services shall comply with

federal laws, rules and regulations applicable to subcontractors of government contracts including those relating to equal employment opportunity and affirmative action in the employment of minorities (Executive Order 11246), women (Executive Order 11375), persons with disabilities (29 USC 706) and Executive Order 11758, and certain veterans (38 USC 4212 formerly [2012]) contracting with business concerns with small disadvantaged business concerns (Publication L. 95-507). Contract clauses required by the Government in such circumstances are incorporated herein by reference.

13.5 Supplier Diversity Goal Program

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

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

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

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

13.5.5 The Contractor and his subcontractors shall develop, implement, maintain, and submit in writing to the Director of Facilities Planning & Development, an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed "Affidavit for Affirmative Action" in the form as included in the Contract Documents. For the purpose of this section, an "Affirmative Action Program"

means positive actions to influence all employment practices (including, but not limited to, recruiting, hiring, promoting, and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between 40 and 70), disabled and Vietnam-era veteran status, and handicapped otherwise qualified status. Such affirmative action program shall include:

- .1 A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination.
- .2 The identification of a person designated to handle affirmative action.
- .3 The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion, and discipline.
- .4 The exclusion of discrimination from collective bargaining agreements.
- .5 Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

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

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

13.6.1 The Contractor shall pay workers employed in the execution of this contract in full each week and not less than the predetermined wage rates and overtime for work of a similar character that have been made a part of this Contract. These rates are determined by the University of Missouri Director of Facilities Planning and Development. The rates are based on wage rates published in the Annual Wage Orders of the Missouri Department of Labor and Industrial Relations (MDLIR). The Contractor is to use MDLIR 8 CSR 30-3.020; .030; .040, .060 in determining the appropriate occupational titles and rates for workers used in the execution of this contract. All determinations and/or interpretations regarding wage rates and classification of workers will be made by the office of the University of Missouri Director of Facilities Planning and Development. The Contractor is responsible for the payment of the aggregate of the Basic Hourly Rate and the Total Fringe Benefits to the workers on the project. Fringe benefit payments may be made to the worker in cash, or irrevocably made by a Contractor or Subcontractor to a trustee or to a third person pursuant to a fund, plan or program, or pursuant to an enforceable

commitment, or any combination thereof, to carry out a financially responsible plan or program which was communicated in writing to the workmen affected, for medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing, for unemployment benefits, life insurance, disability and sickness insurance, accident insurance, for vacation and holiday pay, for defraying costs of apprenticeship or other similar programs, or for other bona fide fringe benefits, but only where the Contractor or Subcontractor is not required by other federal or state law to provide any of the benefits as referenced in §290.210(5) RSMo 1994. Pay for travel, mileage, meals, bonuses, or other expenses are not fringe benefits and cannot be considered part of the workers wage rate. The Contractor shall not make any deductions for food, sleeping accommodations, transportation, use of small tools, uniforms, or anything of any kind or description, unless the Contractor and employee enter into an agreement in writing at the beginning of the worker's term of employment, and such agreement is approved by the Owner. In the event the contract contains more than one wage determination the Contractor shall comply with both.

13.6.2 The Contractor shall submit to the Owner with the Contractor's periodic pay request, certified payroll records for labor performed by the Contractor and Subcontractors of any tier. The Contractor shall submit all required certified payroll information records electronically in pdf format using the Owner's web-based payment program. The certified payroll forms shall contain the name, address, personal identification number, and occupational title of the workers as well as the hours they work each day. The Owner's acceptance of certified payroll records does not in any way relieve the Contractor of any responsibility for the payment of prevailing wages to workers on the project. The Contractor shall also maintain copies of the certified payroll records. The Owner may, at any time, request copies of, and/or inspect all of the Contractor's payroll records for the Work to verify compliance. The Contractor shall furnish the Owner copies of payroll records within 10 days of the Owner's written request. The Contractor shall provide copies of workers I-9 forms within 24 hours of written notice. (If applicable, and required by Owner, the Contractor will demonstrate that the Contractor is enrolled and participating in a federal work authorization program with respect to the employees working in connection with this project.) Such payroll records shall be maintained in accordance with Article 13.7.1 and shall be available for inspection for two (2) years after final completion of the Work. The contractor further agrees, in the event the records are not presented as requested, he will abide by any decision made by the Owner regarding underpayment of wages to workers and amounts owed them as well as liquidated damages for underpayment of wages. Falsification of the certified payroll records may

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

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

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

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

13.6.6 The Owner may deduct liquidated damages described Article 13 and the amounts set forth in Article 13 from any unpaid amounts then or thereafter due the Contractor under the Contract. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner.

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

13.6.8 Contractor acknowledges and recognizes that a material factor in its selection by the Owner is the Contractor's willingness to undertake and comply with the requirements of this Article 13.6. If Contractor fails to comply with the provisions of this Article 13.6, Owner may, in its sole discretion, immediately terminate the Contract

upon written notice. The rights and remedies of Owner provided herein shall not be exclusive and are in addition to other rights and remedies provided by law or under this Contract.

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

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

13.6.11 Neither the Contractor, nor any Subcontractor of any tier, nor any person hired by them or acting on their behalf, shall request or demand that workers pay back, return, donate, contribute, or give any part, or all, of said workers wages, salary, or any thing of value, upon the statement, representation or understanding that failure to comply with such request or demand will prevent such worker from procuring or retaining employment. The exception being to an agent or representative of a duly constituted labor organization acting in the collection of dues or assessments of such organization.

13.6.12 No contractor or subcontractor may directly or indirectly receive a wage subsidy, bid supplement, or rebate for employment on this project if such wage subsidy, bid supplement, or rebate has the effect of reducing the wage rate paid by the employer on a given occupational title below the prevailing wage rate as provided in contract. In the event a wage subsidy, bid supplement, or rebate is provided or received, the entity receiving such subsidy, supplement, or rebate shall report the date and amount of such subsidy, supplement, or rebate to the University within thirty days of receipt of payment. This disclosure report shall be a matter of public record. Any employer not in compliance with this Article shall owe to the University double the dollar amount per hour that the wage subsidy, bid supplement, or rebate has reduced the wage rate paid by the employer below the prevailing wage rate for each hour that work was performed.

13.6.13 Time and one-half overtime will be paid on all hours over 10 hours per day or 40 hours per week. The wage rate is the total of the "Basic Hourly Rate" plus "Total Fringe Benefits" or the "public works contracting minimum wage". For all work performed on a Sunday or

Holiday, not less than twice the prevailing hourly rate of pay or public works contracting minimum wage will apply. Holidays are as follows: January first, the last Monday in May, July fourth, the first Monday in September, November 11, the fourth Thursday in November, December twenty-fifth. If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

13.7 Records

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

13.8 Codes and Standards

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

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

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

13.9 General Provisions

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

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

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

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

13.9.5 Contractor agrees that Owner shall not be liable to Contractor for any special, indirect, incidental, or consequential damage whatsoever, whether caused by

Owner's negligence, fault, errors or omissions, strict liability, breach of contract, breach of warranty or other cause or causes whatsoever. Such special, indirect, incidental or consequential damages include, but are not limited to loss of profits, loss of savings or revenue, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar types of damages.

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

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

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

13.10 Certification

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

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

ARTICLE 14
TERMINATION OR SUSPENSION OF THE
CONTRACT

14.1 Termination by Owner for Cause

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

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

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

- .1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 accept assignment of subcontracts pursuant to Paragraph 5.3; and
- .3 finish the Work by whatever reasonable method the Owner may deem expedient, including turning the Work over to the surety.

14.1.3 The Contractor, in the event of a termination under Section 14.1, shall not be entitled to receive any further payments under the Contract until the Work is completed in its entirety. Then, if the unpaid balance

under the Contract shall exceed all expenses of the Owner in finishing the Work, including additional compensation for the Architects services and expenses made necessary thereby, such excess will be paid to the Contractor; but, if such expenses of Owner to finish the Work shall exceed the unpaid balance, the Contractor and its surety shall be liable for, and shall pay the difference and any damages to the Owner. The obligation of the Contractor and its surety for payment of said amounts shall survive termination of the Contract.

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

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

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

14.2 Suspension by the Owner for Convenience

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

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

- .1 that performance is, was, or would have been so suspended, delayed or interrupted by another cause for which the Contractor in whole or in part is responsible, or
- .2 that an equitable adjustment is made or denied under another provision of this Contract.

14.3 Owner's Termination for Convenience

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

14.3.2 Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance

of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- .1 cease operation as specified in the notice;
- .2 place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete Work not terminated;
- .3 terminate all subcontracts and orders to the extent they relate to the Work terminated;
- .4 proceed to complete the performance of Work not terminated; and
- .5 take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

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

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

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

SECTION 1.E

SPECIAL CONDITIONS

1. DEFINITIONS

a. "Drawings"

Drawings referred to in and accompanying Project Manual consist of Drawings prepared by and bearing name of below defined Architect, bearing Date of 03/22/2024, entitled "Memorial Stadium – North Concourse Video Board Replacement", project number CP241291.

b. Architectural

Populous
4800 Main Street, Ste. 300
Kansas City, MO 64112
(816) 221-1500

Electrical

Henderson Engineers
1801 Main Street, Ste. 300
Kansas City, MO 64108
(816) 863-8700

Audio-Visual

WJHW
3424 Midcourt Rd., Ste. 124
Carrollton, TX 75006
(972) 934-3700

Structural

Cornerstone Engineering Inc.
1020 William Blunt Drive
Maryville, TN 37801
(865) 273-2688

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

2. SPECIAL SCHEDULING REQUIREMENTS

- ##### a. Normal working hours are defined as weekdays between the hours of 7:00 AM and 5:00 PM. Access and work efforts outside of these normal working hours to be coordinated with the Owner's Representative

- b. Critical path for long lead items in the form of a videoboard and sound equipment package has been released through a Procurement package by the Owner's Representative.
- c. Delivery of the videoboard by Daktronics will need to be coordinated with the Owner's Representatives, MCA and applicable subcontractors. Videoboard is scheduled to arrive May 2024
- d. Construction installation must be complete by August 2, 2024. Videoboard commissioning will begin August 5, 2024.
- e. Videoboard must be operational by August 24, 2024, for the 2024 MU Home Opener Football Game.
- f. Project will need to coordinate site access with the Summer Paving Project and Repair Work in Parking Lots SG7/B & SG/7.

3. SCOPE OF WORK

- a. The Contractor shall furnish all labor, materials, tools, equipment necessary for, and incidental to, construction of this project as indicated on Drawings and specified herein.
- b. Work shall include everything requisite and necessary to finish work properly, notwithstanding that every item of labor or materials or accessories required to make project complete may not be specifically mentioned.
- c. General Description of Work: Memorial Stadium north concourse video board replacement, consisting of the following work:
 - (1) Demolition shall consist of removal of existing field-side video board, scoreboard and ribbon board; removal of existing street-side video board; selective demolition of existing audio system in accordance with new system; selective demolition of existing formed metal wall panels and associated trim.
 - (2) Work shall consist of new structural framing and catwalk at east and west ends of existing structure/catwalk for attachment of and access to new field-side and street-side video boards; modifications to audio system; covering of exposed structure/catwalk with formed metal wall panels matching existing; enclosing top and bottom of new structure/catwalk with bird control netting.

4. LOCATION

- a. Work shall be performed under this Contract on campus of the University of Missouri - Columbia, at Memorial Stadium, 1100 South Providence Road, Columbia, MO.

5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner's Representative will furnish the Contractor a copy of executed Contract and a complete set of Drawings and Specifications in PDF format.
- b. The Owner will provide electronic data files to the Contractor for their convenience and use in progressing the Work and the preparation of shop drawings or other submittal requirements required for construction of the referenced project. The electronic data files shall reflect Construction Documents and Bid Addenda only. These files will be transmitted subject to the following terms and conditions:
 - (1) The Owner makes no representation as to the compatibility of these files with the Contractor's hardware or software.
 - (2) Data contained on these electronic files shall not be used by the Contractor or anyone else for any purpose other than as a convenience in progressing the Work or in the preparation of shop drawings or other required submittals for the referenced project. Any other use or reuse by the Contractor or by others will be at their own sole risk and without liability or legal exposure to Owner. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the Owner and its consultants, contractors, agents, employees, and representatives that may arise out of or in connection with the use of the electronic files transmitted.
 - (3) Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless the Owner and its consultants, contractors, agents, employees, and representatives, against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.
 - (4) These electronic files are not contract documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. The Owner makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by the Consultant and the electronic files, the signed and sealed hard-copy construction documents shall govern. The Contractor is responsible for determining if any conflict exists. By use of these electronic files, the Contractor is not relieved of their duty to fully comply with the contract documents.

- (5) Because information presented on the electronic files can be modified, unintentionally or otherwise, the Owner reserves the right to remove all indications of ownership and/or involvement from each electronic display.
- (6) Under no circumstances shall delivery of the electronic files be deemed a sale by the Owner and no warranties are made, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall the Owner be liable for any loss of profit, or any consequential damages as a result of use or reuse of these electronic files.

6. SUBMITTALS

- a. The Contractor shall submit for approval to the Architect, equipment lists and Shop Drawings, as expediently as possible. Failure of the Contractor to submit Shop Drawings in a timely manner will result in the Owner holding back Contractor payments. (See General Conditions)
- b. The material and equipment lists shall be submitted and approved before any material or equipment is purchased and shall be corrected to as-built conditions before the completion of the project.
- c. The Contractor shall submit electronic versions of all required Shop Drawings, material and equipment lists. The Contractor shall upload all Shop Drawings to a secure information sharing website determined by the Owner notifying the Owner and Consultant that these shop drawings are available for review. Each submittal shall have the General Contractors digital stamp affixed to the first page signifying their review and acceptance. Review comments, approvals, and rejections will be posted on this same site with notification to the contractor. Submittals requiring a professional seal shall be submitted hard copy with a manual seal affixed.
 - (1) The Contractor shall identify each submittal item with the following:
 - (a) Project Title and Location
 - (b) Project Number
 - (c) Supplier's Name
 - (d) Manufacturer's Name
 - (e) Contract Specification Section and Article Number
 - (f) Contract Drawing Number
 - (g) Acrobat file name: Spec Section_Times Submitted-Spec Title:
(Example - 033000 _01-Cast In Place Concrete.pdf)
 - (2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.4) for required submittal information.

- d. The Contractor shall submit to the Architect one (1) electronic copy, in PDF form of all required Operating Instructions and Service Manuals with one PDF file per specification division for the Architect's and the Owner's sole use prior to completing 50% of the adjusted contract. Payments beyond 50% of the contract amount may be withheld until all Operating Instructions and Service Manuals are received as referenced in the accompanying Operating Instructions and Service Manual Log at the end of this section (1.E.5).
- e. The Contractor shall submit to the Owner's Representative all items referenced in the accompanying Closeout Log (1.E.6) within 30 days following substantial completion of the work. The Owner's Representative will maintain the closeout log and include as an agenda item at all coordination meetings.

7. NOTIFICATION

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

8. USE OF PREMISES

- a. Access: Access to construction site shall be as indicated on Drawings and as directed by the Owner's Representative.
- b. Parking:
 - (1) The Owner will issue Contractor two (2) service vehicle parking permits for use in University Parking lot SG/7. The permits will be issued at no cost to the contractor up to the contract completion date. After the contract completion date, the permits will be re-issued on an as available basis at the contractors' expense. These permits are to be used for general contractor or subcontractor owned and labeled vehicles only. Personal vehicles are prohibited from use of these permits. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.
 - (2) Parking of personal vehicles within project access/lay down/staging areas is prohibited. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.

- (3) Parking or driving on sidewalks, landscaped areas, within fire and service lanes or generally in areas not designated for vehicular traffic is prohibited except as allowed in the contract documents. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.
 - (4) Free parking for contractor employees is available in the Ashland Road Contractor lot on an as available basis. This space is for use by contractor employees for parking their personal vehicles only and is not to be used for staging or storage.
 - (5) Vendor Permits may be purchased by contractor management personnel on an as available basis by contacting the Parking and Transportation office in the General Services Building. These permits will allow contractor management personnel to park in various University lots while conducting business on University construction projects.
 - (6) Temporary University parking permits may be purchased by contractor employees for use with their personal vehicles on an as available basis by contacting the Parking and Transportation office in the General Services Building.
 - (7) Conley Avenue between Missouri Avenue and University Avenue and Hitt Street between University Avenue and the Memorial Union are designated for pedestrian use only during the work week between the hours of 8:15 AM and 3:45 PM. Unless otherwise indicated in the contract documents, this area is strictly off limits to vehicular traffic without authorization from the Owner's Representative.
- c. Storage of materials: The Contractor shall store all materials within project limits. The Contractor shall confine apparatus, materials, and operation of workers to location established by the Owner's Representative. The Contractor shall not unreasonably encumber premises with materials. In addition, storage trailer locations may be available within 1-1/2 miles of project site as directed by the Owner's Representative. Storage trailer locations shall be subject to approval by the Owner's Representative and are available to the Contractor without cost.
- d. Utilities: Drinking water, water required to carry on work, and 120 volt electrical power required for small tool operation may be obtained without cost to the Contractor from existing utilities at locations designated by the Owner's Representative. Provisions for obtaining power, including temporary extensions, shall be furnished and maintained by the Contractor. Upon completion of work such extensions shall be removed and any damage caused by use of such extensions shall be repaired to satisfaction of the Owner's Representative, at no cost to the Owner.

- e. Restroom: Existing toilet facilities within Project Limits or Restrooms designated by the Owner's Representative for use by the Contractor will be available. Failure of the Contractor to maintain restrooms in a clean condition will be cause for the Contractor's discontinued use of the restroom.
- f. Smoking is prohibited at the University of Missouri and all properties owned, operated, leased or controlled by the University of Missouri. Violation of the policy is defined as smoking any tobacco products, including e-cigarettes.
- g. Landfill: The Contractor shall not use the Owner's landfill. Dumping or disposal of excavated or demolition materials on Owner's property shall not be permitted. The Contractor shall remove and legally dispose of excavated or demolished materials off the Owner's property.
- h. Care of Project Work Site: The contractor shall be responsible for maintaining the construction site in a reasonably neat and orderly condition by regular cleaning and mowing of the premises as determined by the Owner's Representative.
- i. Discharge to Sewer Request: The University of Missouri's MS4 permit and NPDES Storm Water Discharge Permits along with the City of Columbia's POTW Operating Permit as well as local ordinances, and state and federal environmental regulations prohibit hazardous materials from being disposed into either the storm water or sanitary sewer systems. Unless specifically approved, all chemical products such as paints, dyes, lawn care products, maintenance products, and oil ~~is~~ are prohibited from drain disposal. Any product, including contaminated water, being discarded into the storm water or sanitary sewer systems requires written approval from the Owner through a formal "Discharge to Sewer Request" form obtained at Discharge to Sewer Request Form. The contractor should submit the form to the Owner's Representative, not to the Department of Environmental Health and Safety as the form indicates.
- j. All concrete waste material including washout water shall be totally contained and removed from the Owner's property.
- k. Artifacts Found During Construction: Contractor shall immediately notify the Owner's Representative when artifacts are uncovered or found during the demolition or construction process. Artifacts include, but are not limited to, tools, drawings (construction or other), photographs, books and other objects/devices which may hold historical importance/significance. Do not remove or disturb the object(s) in question. Artifacts are not considered part of demolished materials and shall remain the property of the University of Missouri.

9. PROTECTION OF OWNER'S PROPERTY

- a. The Contractor shall be responsible for repair of damage to building exterior and interior, drives, curbs, streets, walks, grass, shrubbery and trees, which was caused by workmen or equipment employed during progress of work. All such repairs shall be made to satisfaction of the Owner's Representative, at no cost to the Owner, or reimburse the Owner if the Owner elects to make repairs. For landscape damage, the Owner shall make such repairs. Compensation for these repairs shall be determined by the Owner's Representative using the "Valuation of Landscape Trees, Shrubs, and other Plants" as published by the International Society of Arboriculture, as last revised.
- b. Preserving and Protecting Existing Vegetation:
 - (1) Protection and compensation for damages:
 - (a) Trees and shrubs within work area designated to remain shall be protected from damage during construction by fencing or armoring as indicated on Drawings or specified herein. Plant protection devices shall be installed before work has begun and shall be maintained for duration of work unless otherwise directed by Owner's Representative.
 - (2) Plants within work area designated for removal shall be removed by Contractor.
 - (3) To prevent compaction of soil over tree roots, vehicles or equipment shall not at any time park or travel over, nor shall any materials be stored within drip line of trees designated to remain.
 - (4) Owner's Representative will stop work immediately when proper measures are not being employed to protect trees and shrubs. Contractor will be notified to resume work after required protection measures are implemented
 - (5) Pruning of limbs necessary to repair damage or provide clearance for work shall be done by the MU Landscape Services Department at the direction of the Owner's Representative. Limbs shall be cut off cleanly and cut surfaces treated according to established horticultural standards.

10. SUBSTITUTIONS and EQUALS

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

are defined General Conditions Article 3.12 .

- b. Use of materials, products or equipment other than those named and described in the Contract Documents are substitutions *and/or equal*. Substitutions *and/or equals* of any item described in the Contract Documents will be allowed only prior to the receipt of bids provided that a request for approval has been received by both the Architect and the Owner at least ten calendar days prior to the date for receipt of Bids. To be considered, bidder's *proposal* shall include a complete description of the proposed substitution *and/or equal* and a comparison of significant qualities of the proposed substitution *and/or equal* with those specified including drawings, performance and test data, and other information necessary for an evaluation. The Architect's decision on the approval or disapproval of a proposed substitution *and/or equal* shall be final.
- 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 General Conditions.

12. PERMITS

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

13. MODIFICATION TO INFORMATION FOR BIDDERS

- a. Information to Bidders:
 - (1) Referenced Information to Bidders, Page IFB/6.
Add new Article 15.9.2 as follows:

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

14. PROJECT SCHEDULING

- a. The project scheduling specification for the project are included immediately after the Special Conditions. For this project the Contractor shall meet the following scheduling requirements.
 - (1) Option #1 - Contractor Schedule (Small Projects only): Contractor is responsible for the schedule and must comply with the Owner's requirements. See Contractor Schedule Specification included in these documents.

15. PROJECT COORDINATION

- a. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
 - (1) Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - (2) Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - (3) Make provisions to accommodate items scheduled for later installation.
- b. Coordination Drawings: Within fourteen (14) days of Notice to Proceed provide coordination drawings for the integration of the Work, including work first shown in detail on shop drawings or product data. 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.
 - (1) Show the interrelationship of components shown on separate shop drawings.
 - (2) Indicate required installation sequences.
 - (3) Call attention in advance to Architect of any dimensional or detail information needed to complete the coordination drawings.

16. SAFETY PRECAUTIONS AND PROGRAMS

- a. The contractor shall provide Emergency Contact Information for the Contractor's on-site staff and home office management as well as contact information for all major subcontractor personnel. This information shall contain business and personal phone numbers for each individual for

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

17. GENDER NEUTRAL SIGNAGE

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

18. HOT WORK PERMITTING AND GENERAL REQUIREMENTS

- a. Hot work Requirements: The contractor shall comply with the following hot work requirements and the requirements of the International Fire Code and 2014 NFPA 51B.
- b. Hot work shall be defined as any work involving burning, welding, grinding, cutting, or similar operations that are capable of initiating fires or explosions.
- c. The Contractor shall utilize the hot work permit decision tree and permit provided in the 2014 NFPA 51B for all Hot Work operations.
- d. A hot work permit shall be used on all hot work performed outside a designated hot work area. The hot work permit shall be posted and clearly visible within proximity of the hot work area. The hot work permit authorizing individual (PAI) shall be as designated by the Contractor.
- e. Notify the Owner's Representative 24 hours prior to starting hot work in buildings with operational fire alarm or fire suppression systems. The Owner's Representative will coordinate the appropriate system outage with Campus Maintenance personnel.
- f. Unless otherwise instructed by the Owner's Representative, the Contractor shall post a copy of each completed hot work permit to the Owner's project management file system the following business day.

19. GENERAL REQUIREMENTS FOR CRANE AND HOISTING OPERATIONS

- a. All crane and hoisting operations shall be performed in compliance with OSHA 29 CFR 1926. All Operators, riggers, and signal persons must have the proper qualifications and training necessary to perform the intended hoisting activities for this project.
- b. Only fully certified and evaluated Operators shall perform equipment operations. Operators in an "Operator in Training" status shall not be used.
- c. Submittal requirements:
 - 1. Submit copies of Operator certifications, licenses, and evaluations to the Owners Representative.

2. Submit Rigger and Signal Person qualifications to the Owners Representative.
3. Unless otherwise directed by the Owners Representative, submit a lift plan, and conduct a lift coordination meeting for hoisting or crane operations for any lift greater than 2,000 pounds, or for any multi pick lift. Include protective measures for existing underground utilities, occupied buildings, pedestrian and vehicle pathways, adjacent buildings, and overhead power lines. If the lift is to occur over an occupied building, provide a registered structural engineer's review and verification that the building can resist the impact of a dropped load for the intended lift. If evacuation of an occupied building is necessary to conduct the lift, the decision for building evacuation or scheduling the lift for off-hours will be determined by the Owner.

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

END OF SECTION

SECTION 1.E.1

SCHEDULING SPECIFICATION

1. GENERAL

- a. Time is of the essence for this contract. The time frames spelled out in this contract are essential to the success of this project. The University understands that effective schedule management, in accordance with the General Conditions and these Special Conditions is necessary to insure to that the critical milestone and end dates spelled out in the contract are achieved.
- b. Related Documents
Drawings and general provisions of the Contract, including General Conditions' Article 3.17 shall apply to this Section.
- c. Stakeholders
A Stakeholder is anyone with a stake in the outcome of the Project, including the University, the University Department utilizing the facility, the Design Professionals, the Contractor and subcontractors.
- d. Weather
 - (1) Contractor acknowledges that there will be days in which work cannot be completed due to the weather, and that a certain number of these lost days are to be expected under normal weather conditions in Missouri.
 - (2) Rather than speculate as to what comprises "normal" weather at the location of the project, Contractor agrees that it will assume a total of 44 lost days due to weather over the course of a calendar year, and include same in its as planned schedule. For projects of less than a calendar year, lost weather days should be prorated for the months of construction in accordance with the following schedule.
 - (3) Anticipated weather days for allocation/proration only. For projects lasting 12 months or longer, the 44 days per year plus whatever additional months are included will constitute normal weather.

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

2. SCHEDULING PROCESS

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

b. Contractor Requirements

(1) Schedule Development

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

(2) Schedule Development

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

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

(3) Schedule Updates

(a) Schedule Updates will be conducted once a month, at a minimum.

Actual Start and Finish dates should be recorded regularly during the month. Percent Complete, or Remaining Duration shall be updated as of the data date, just prior to Contractor's submittal of the update data.

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

(c) Contractor will meet with the Owner's Representative to review the draft of the updated schedule. At this meeting, Owner's Representative and Contractor will:

(i) Review out of sequence progress, making adjustments as necessary

(ii) Add any fragments necessary to describe changes or other impacts to the project schedule

- (iii) Review the resultant critical and near critical paths to determine any impact of the occurrences encountered over the last month.
- (4) Schedule Narrative

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

- (5) Progress Meetings
 - (a) Review the updated schedule at each monthly progress meeting. Payments to the Contractor may be suspended if the progress schedule is not adequately updated to reflect actual conditions.
 - (b) Submit progress schedules to subcontractors to permit coordinating their progress schedules to the general construction work. Include 4 week look ahead schedules to allow subs to focus on critical upcoming work.

3. CRITICAL PATH METHOD (CPM)

- a. This Section includes administrative and procedural requirements for the critical path method (CPM) of scheduling and reporting progress of the Work.
- b. Refer to the General and Special Conditions and the Agreement for definitions and specific dates of Contract Time.
- c. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the Project.
- d. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall project duration.
- e. Network Diagram: A graphic diagram of a network schedule, showing the activities and activity relationships.
- f. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling, the construction project. Activities included in a construction schedule consume time and resources.
- g. Critical activities are activities on the critical path.
- h. Predecessor activity is an activity that must be completed before a given activity can be started.

- i. Milestone: A key or critical point in time for reference or measurement.
- j. Float or Slack Time: The measure of leeway in activity performance.
- k. Accumulative float time is not for the exclusive use or benefit of the Owner or Contractor, but is a project resource available to both parties as needed to meet contract milestones and the completion date.
- l. Total float is herein defined as the measure of leeway in starting or completing an activity without adversely affecting the planned project completion date.
- m. Weather: Adverse weather that is normal for the area must be taken into account in the Contractor's Project Schedule. See 1.d.3, above.
- n. Force Majeure Event: Any event that delays the project but is beyond the control and/or contractual responsibility of either party.
- o. Schedule shall including the following, in addition to Contractor's work.
 - (1) Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
 - (a) Requirements for phased completion and milestone dates.
 - (b) Work by separate contractors.
 - (c) Work by the Owner.
 - (d) Coordination with existing construction.
 - (e) Limitations of continued occupancies.
 - (f) Uninterruptible services.
 - (g) Partial occupancy prior to Substantial Completion.
- p. Area Separations: Use Activity Codes to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

4. TIME EXTENSION REQUEST

- a. Refer to General Conditions of the Contract for Construction, Article 4.7 Claims for Additional Time.
- b. Changes or Other Impacts to the Contractor's Work Plan
The Owner will consider and evaluate requests for time extensions due to changes or other events.

SECTION 1.E.4

SHOP DRAWING AND SUBMITTAL LOG

Project: Memorial Stadium – North Concourse Video Board Replacement
 Project Number: CP241291
 Contractor:

Section	Description	Contractor	Discipline Responsible	Date Received	Date Returned	Comments
02 41 19	Selective Demolition – Engineering Survey					
02 41 19	Selective Demolition – Schedule of Selective Demolition Activities					
05 40 00	Cold-Formed Metal Framing – Delegated Design Submittal					
05 40 00	Cold-Formed Metal Framing – Shop Drawings					
05 40 00	Cold-Formed Metal Framing – Product Data, Certificates, Test Reports					
07 41 13.16	Standing-Seam Metal Roof Panels – Product Data, Test Reports, Sample Warranty					
07 41 13.16	Standing Seam Metal Roof Panels – Shop Drawings					
07 41 13.16	Standing Seam Metal Roof Panels – Samples					
07 41 13.16	Standing Seam Metal Roof Panels – Installer Qualification Data					
07 42 13.13	Formed Metal Wall Panels – Product Data, Test Reports, Sample Warranty					
07 42 13.13	Formed Metal Wall Panels – Shop Drawings					
07 42 13.13	Formed Metal Wall Panels – Samples					
07 42 13.13	Formed Metal Wall Panels – Installer Qualification Data					
10 81 13	Bird Control Devices – Product Data, Certificates, Sample Warranty					
10 81 13	Bird Control Devices – Shop Drawings					

SECTION 1.E.4

SHOP DRAWING AND SUBMITTAL LOG

Project: Memorial Stadium – North Concourse Video Board Replacement
 Project Number: CP241291
 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>
10 81 13	Bird Control Devices – Samples					
10 81 13	Bird Control Devices – Installer Qualification Data					
26 05 00	Electrical - Sleeve Seals – Product Data					
26 05 00	Electrical – Penetration Firestopping Systems – Product Data					
26 05 00	Electrical – Joint Sealers – Product Data					
26 05 19	LV Elec. Power Conductors and Cables – Testing Agency Qualification Data					
26 05 19	LV Elec. Power Conductors and Cables – Field Quality-Control Test Reports					
26 05 19	LV Elec. Power Conductors and Cables – Product Data					
26 05 26	Grounding and Bonding – Product Data					
26 05 26	Grounding and Bonding – Field Quality-Control Test Reports					
26 05 33	Raceway and Boxes – Product Data					
26 05 33	Raceway and Boxes – Shop Drawings					
26 05 53	Identification for Electrical Systems – Product Data					
26 05 73	Low-Voltage Electrical System Studies – Product Data, Certificates					
26 05 73	Low-Voltage Electrical System Studies – Qualification Data					
26 05 73	Low-Voltage Electrical System Studies – Coordination Study Report					
26 05 73	Low-Voltage Electrical System Studies – Equipment Evaluation Report					

SHOP DRAWING AND SUBMITTAL LOG

Project: Memorial Stadium – North Concourse Video Board Replacement
 Project Number: CP241291
 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>
26 05 73	Low-Voltage Electrical System Studies – Setting Report					
26 05 73	Low-Voltage Electrical System Studies – Arc-Flash Hazard Analysis					
26 24 16	Panelboards – Product Data					
26 24 16	Panelboards – Shop Drawings					
26 24 16	Panelboards – Fault-Current and Coordination Studies					
26 24 16	Panelboards – Overcurrent Protective Device Settings Report					
26 24 16	Panelboards – Field Quality-Control Reports					
26 24 16	Panelboards – Schedules					
27 41 16	Audio-Visual Systems – Product Data					
27 41 16	Audio-Visual Systems – Shop Drawings and Fabrication Details					
27 41 16	Audio-Visual Systems – Equipment Housing					
27 41 16	Audio-Visual Systems – Patch Panel Layouts					
27 41 16	Audio-Visual Systems – Structural Rigging and Mounting Details					

SECTION 1.E.5

OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG

Project: Memorial Stadium – North Concourse Video Board Replacement
 Project Number: CP241291
 Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
07 41 13.16	Standing Seam Metal Roof Panels – Maintenance Data							
07 42 13.13	Formed Metal Wall Panels – Maintenance Data							
10 81 13	Bird Control Devices – Maintenance Data							
26 24 16	Panelboards – Operation and Maintenance Data							
27 41 16	Audio-Visual Systems – Equipment Manuals							
27 41 16	Audio-Visual Systems – System Operation and Instructions							
27 41 16	Audio-Visual Systems – Service Information							
27 41 16	Audio-Visual Systems – Test Reports							

SECTION 1.F

INDEX OF DRAWINGS

Drawings referred to in and accompanying Project Manual consists of following sheets dated March 22, 2024.

G001:	Cover: Drawing Index and Project Notes
S1:	General Drawings and Notes
S2:	Displays
S3:	Framing Drawings
S4:	New End Framing
S5:	Details and Isometrics
S6:	Details
E0:	Electrical Legend and Notes
E1:	Electrical One-Line Diagrams
V200:	Electrical Index and Notes
V201:	Electrical Riser Diagrams
V300:	Index, Notes and Responsibility Matrix
V301:	Front Elevation View
V302:	Rear Elevation View
V303:	Plan Views
V304:	Section Views
V305:	Structure Elevation
V306:	Display Details
V307:	Audio Shop Drawing
V308:	Audio Electrical / Controls
AV000:	General Notes, Legends
AV001:	General Notes, Legends
AV090:	A-V Equipment Rack Details
AV1100:	A-V Functional Legend, Standard Details
AV1101:	A-V Functional Legend, Standard Details
AV1112:	Functionals
AV1190:	Demolition Plan
AV1191:	Scoreboard Loudspeakers
AV1192:	Loudspeaker Aiming Detail
A5.01	AT&T North End Scoreboard Elevation (for reference)
A6.01	AT&T Scoreboard Antenna Layout (for reference)

END OF SECTION

SECTION 1.G

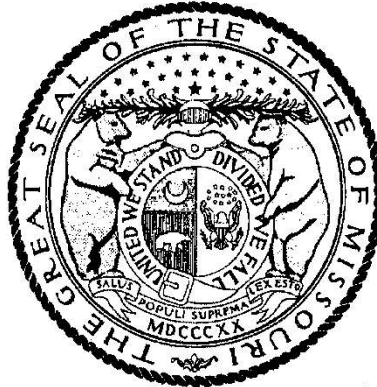
PREVAILING WAGE RATES

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

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 30

Section 010
BOONE COUNTY

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

Original Signed by

Todd Smith, Director
Division of Labor Standards

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

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

Prepared by Missouri Department of Labor and Industrial Relations

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

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

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

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

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

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

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

OVERTIME and HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

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

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

SECTION 02 41 19 - SELECTIVE DEMOLITION**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

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 PRE- DEMOLITION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished or removed.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review items to be salvaged,

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for

protecting individuals and property, for dust control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, which might be misconstrued as damage caused by demolition operations.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
 - 1. Roofing.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

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 ASSE 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. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video, and templates.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Verify items designated to remain is tagged or identified.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC 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. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. 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.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Protect bench marks, survey control points, and existing structures from damage or displacement.
- C. 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.
- D. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. 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.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. 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.
 5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area on-site designated by Owner.
 5. Protect items from damage during transport and storage.
- D. 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 transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Break down demolition waste according to waste management plan or as noted below:
- B. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- C. Concrete: 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.
- D. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- E. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- F. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 SALVAGE MATERIALS

- A. Salvage: Items to be removed and salvaged are indicated on Drawings:

3.8 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.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.9 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

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Ceiling joist framing.
 - 3. Soffit framing.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 09 22 16 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Review methods and procedures related to cold-formed metal framing installation, including those contained in metal framing engineer's delegated design submittal.
- C. Review design loads imposed on building structure.
 - 1. Review and clearly identify locations of interior and corner wind load zones of building façade.
 - 2. Review design wind speeds and resulting positive and negative loads imposed on metal framing and exterior sheathing at interior zones and corner zones of building façade.
 - 3. Review securement of system components required to withstand design wind loads, including the following:
 - a. Attachment of bottom track to floor structure, and type and spacing of fasteners.
 - b. Attachment of top track to overhead structure, and type and spacing of fasteners.
 - c. Attachment of studs to top and bottom tracks.
 - d. Attachment of vertical deflection and/or drift clips to overhead structure.
 - e. Attachment of studs to vertical deflection and/or drift clips.
 - f. Review required minimum edge clearance from edge of slab, and size, spacing, and required penetration of fasteners.
- D. Review requirements and understanding of Field Quality Control article.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Provide Shop Drawings prepared by cold-formed steel framing manufacturer.
 - a. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - b. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated Design Submittal: For cold-formed steel framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- E. Research Reports:
 - 1. For nonstandard cold-formed steel framing from ICC-ES, or other qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Steel framing manufacturer to have a third-party evaluation report for its products that are reviewed to the local building code or its model code (IBC **2021** and AISI S100).
 - 3. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA).
 - 1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed steel framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA).
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- G. Comply with the following AISI specifications and standards:
 - 1. AISI S240, "North American Standard for Cold-Formed Steel Structural Framing."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or a comparable product approved by Architect:
1. AllSteel & Gypsum Products, Inc.
 2. CEMCO; California Expanded Metal Products Company.
 3. ClarkDietrich Building Systems, Inc.
 4. Consolidated Fabricators Corp.; Building Products Division.
 5. MarinoWARE.
 6. MBA Metal Framing.
 7. SCAFCO Corporation.
 8. Steel Network, Inc. (The).
 9. Steeler, Inc.
 10. Telling Industries, LLC.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer (Metal Framing Engineer), as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing, including fasteners and connections to building structure.
- B. Structural Performance: Provide cold-formed steel framing and connections capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Structural Drawings.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of $1/360$ of the wall height.
 - b. Interior Load-Bearing Wall Framing: Horizontal deflection of $1/360$ of the wall height under a horizontal load of 5 lbf/sq. ft..
 - c. Exterior Non-Load-Bearing Framing: Horizontal deflection of $1/720$ of the wall height.
 - d. Interior Non-Load-Bearing Framing: Horizontal deflection of $1/360$ of the wall height under a horizontal load of 20 lbf/sq. ft..
 - e. Roof Joist Framing: Vertical deflection of $1/240$ of the span for live loads and $1/240$ for total loads of the span.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Wind Design: Refer to the Structural Drawings.
 5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of $3/4$ inch or as indicated on Structural Drawings.
 6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards:
1. AISI S240.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S240.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Framing Members, General: Comply with AISI 240 for conditions indicated.
- B. Steel Sheet for Vertical Deflection and/or Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90 when exposed to moisture.

2.4 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Steel Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Steel Thickness: Matching steel studs.
 - 2. Flange Width: 1-3/8 inches.
- C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: As noted on Structural Drawings or 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: As noted on Structural Drawings or 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch
 - b. Flange Width: Outer deflection track flange width plus 1 inch.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.

2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch. Flange Width: 1-5/8 inches, minimum.
 2. Flange Width: , minimum.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole-reinforcing plates.
 11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hex-headed bolts, and carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener systems of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES A70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20, Type II-Organic, and the following:
1. Zinc Content: 95 percent, minimum.
 2. Solids: 52 percent by volume, minimum.
 3. Dry film thickness not less than 1.5 mils per coat.
 4. Color: Flat grey finish matching original hot-dipped galvanizing.

5. Available Product: ZRC Cold Galvanizing Compound; ZRC Worldwide.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout, containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches unless otherwise indicated.
 2. Decrease spacing between studs (or increase minimum base-metal thickness) where required to ensure cold-formed metal framing system installation will withstand positive and negative wind pressures imposed by design wind speeds, as indicated in Shop Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 1. Install solid blocking at centers indicated.
 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Submit written report that work has been reviewed for compliance by Contractor, Installer, and Metal Framing Engineer, and is ready for inspection by Testing Agency.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect, and Metal Framing Engineer.
- E. Remove and replace work where inspections indicate that it does not comply with specified requirements. Do not cover or conceal corrected work until it has been reinspected for compliance with requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

THIS IS INTENTIONALLY LEFT BLANK

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Standing-seam metal roof panels.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for plywood sub roof.
 - 2. Section 07 42 13.13 "Formed Metal Wall Panels" for metal panels used in fascia applications with this Section.
 - 3. Section 07 62 00 "Sheet Metal Flashing and Trim" for concealed gutters, part of the roof edge construction.
 - 4. Section 07 71 00 "Roof Specialties" for exposed gutters and downspouts, components of the roof-edge drainage system.
 - 5. Section 07 72 53 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel systems during and after installation.
 - 8. Review procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

- C. Samples for Initial Selection: Color chips with factory-applied color finishes for Manufacturer's standard colors.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area and eave, including fascia, and soffit; approximately 12 feet long by 6 feet tall by full thickness, including attachments, underlayment, and accessories.
 - a. Each type of exposed seam and seam termination.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Solar Reflectance Index: Not less than 82 for low slope roofs (2:12 or less) and not less than 39 for steep slope roofs (greater than 2:12) when calculated according to ASTM E 1980.
- B. Energy Performance:
 - 1. Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.
 - 2. Provide roof panels according to one of the following when tested according to CRRC-1:
 - a. Three-year, aged Solar Reflectance Index of not less than 64 for slope roof (2:12 or less) and not less than 32 for steep slope roofs (greater than 2:12) when calculated in accordance with ASTM E 1980.
- C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

- D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft..
- F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels : Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Fabral, Slim Seam or comparable product by one of the following:
 - a. AEP Span; A BlueScope Steel Company.
 - b. Berridge Manufacturing Company.
 - c. CENTRIA Architectural Systems.
 - d. MBCI; a division of NCI Group, Inc.
 - e. PAC-Clad
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Gauge: 22 gauge.
 - b. Exterior Finish Two-coat fluoropolymer.
 - c. Color: Match Existing.
 - 3. Panel Coverage: To match existing.
 - 4. Panel Height: To match existing..

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
 - b. GCP Applied Technologies; Grace Ice and Water Shield HT.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Felt Underlayment: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 hot-dip galvanized coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same

profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. 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. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 1. Apply over the roof area indicated below:
- B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.
 1. Apply over the entire roof surface.
- C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.4 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

THIS IS INTENTIONALLY LEFT BLANK

SECTION 07 42 13.13 - FORMED METAL WALL PANELS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Concealed-fastener, metal wall panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 7. Review temporary protection requirements for metal panel assembly during and after installation.
 8. Review of procedures for repair of metal panels damaged after installation.
 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product; Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Include coordinated details with adjoining substrates.
 3. Include stiffeners or reinforcing as required by the panel engineer.
 4. Show grain direction on all panel elevations.
 5. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
1. Include Samples of trim and accessories involving color selection.

- D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field Quality Control Program: Submit description of procedures for this project to be reviewed and accepted prior to the submittal of field quality control reports.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of formed metal wall panels that are similar to those indicated for this Project in material, design, and extent. Provide engineering for each member and component of the panel assembly, including attachment to building framing as required to comply with concept expressed in Contract Documents that includes, but is not limited to, the following:
 - 1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on building framing.
 - 2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard formed metal wall panels representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Formed metal wall panels shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Loosening or weakening of fasteners, attachments, and other components.
- B. Delegated Design: Design formed metal wall panels, including formed metal wall panel to structure connections, and a comprehensive engineering analysis by a qualified professional engineer registered in the state the project is located, using performance requirements and design criteria indicated.
- C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/175 of the span.

- D. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: Minimum static-air-pressure differential of 6.24 lbf/sq. ft..
- E. Water Penetration under Static Pressure: No water penetration through fixed glazing and framing areas according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: Minimum static-air-pressure differential of 20 percent of positive wind-load pressure but not less than 12 lbf/sq. ft..
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces .
- G. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: As indicated on Drawings.
 - 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Basis of Design Manufacturer and Product:
 - 1. Fabral: Select Series 12
 - 2. Finish: BLACK.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 hot-dip galvanized coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Provide movement joints, stiffeners and reinforcing to eliminate oil canning noise from thermal and building movement.
- F. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- G. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. 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. Aluminum Panels and Accessories:
 1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Depending on square footage of material, two or three tests should be sufficient over the duration of installation.
- B. Water-Spray Test: After installation, test area of assembly shown on Drawings for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Protect panels until accepted by the Owner unless otherwise directed.
- B. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- C. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 81 13 - BIRD CONTROL DEVICES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes the following:
 - 1. Bird netting.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For netting.
- C. Sample Warranty: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For bird control devices to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of bird control devices that fail in materials, including UV resistance, or workmanship within specified warranty period.
 - 1. Warranty Period: 10 year(s) from date of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive bird control devices by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS**2.1 BIRD NETTING**

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Bird Barrier; StealthNet.
 - 2. Nixalite of America Inc.; K-Net HT Bird Netting.
 - 3. Bird-B-Gone, Inc.; Bird Net 2000.

- B. Netting: Ultra-violet stabilized knotted polyethylene.
 - 1. Mesh size: 3/4-inch.
 - 2. Color: Black .
 - 3. Breaking Strength: Not less than 40 lbs.

2.2 ACCESSORIES

- A. Mounting Accessories: Provide manufacturer's stainless steel mounting accessories for complete installation, including, but not limited to, bolts and nuts, tension cables, turnbuckles, fasteners, brackets, and clips.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with manufacturer's requirements for 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. Remove bird droppings and clean area protected by bird control devices prior to installation.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions and recommendations.
- B. Install bird netting taught, completely covering area without wrinkles, gaps, or openings, for longevity, lack of visibility, and to prevent capture of birds.

END OF SECTION

SECTION 26 00 10 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.
- B. Division 26 of these Specifications, and Drawings numbered with prefixes E, generally describe these systems, but the scope of the electrical work includes all such work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.
- C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, outlets and circuits without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.2 DEFINITIONS

- A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:
 - 1. Furnish: "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
 - 2. Install: "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
 - 3. Provide: "To furnish and install complete, and ready for the intended use."
 - 4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.
 - 5. Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the Work under this Division.
 - a. A Consultant to, and an authorized representative of, the Owner, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the "Owner".

6. Contract Administrator: Where referenced in this Division, "Contract Administrator" is the primary liaison between the Owner and the Contractor. Specifically, for this project this is "the Engineer".
 7. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
 8. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.
 9. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
 - a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
 10. Value Engineering: A systematic method to improve the "value" of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
- C. Manufacturers: The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- D. The following definitions apply to excavation operations:
1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 2. Sub-base: as used in this section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.
 3. Sub-grade: as used in this section refers to the compacted soil immediately below the slab or pavement system.
 4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Contract Administrator.

1.3 REFERENCE STANDARDS

- A. Execute all work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the

requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Contract Administrator's and Engineer's attention in sufficient time, prior to the opening of bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

- B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Contract Administrator and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.
- C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.
- D. All material, manufacturing methods, handling, dimensions, methods of installation, and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:

IBC	International Building Code
ADA	Americans with Disabilities Act
AEIC	Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CSA/USA	Canadian Standards Association/USA
ICEA	Insulated Conductors Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code, NFPA 70
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers' Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
UL	Underwriter's Laboratories

- E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.
- F. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the electrical work shall be provided by the Contractor.
- G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with other divisions for electrical work included in them but not listed in Division 26 or indicated on electrical Drawings.
- B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any work covered by this Division.

- C. Refer to Drawings and divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.
- D. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes actually installed.
- E. Maintain an electrical foreman on the jobsite at all times to coordinate this work with other trades so that various components of the electrical systems is installed at the proper time, fits the available space, and allows proper service access to all equipment. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.
- F. Work of this Division shall progress according to the "Construction Schedule" as approved by the Contract Administrator. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.

1.5 MEASUREMENTS AND LAYOUTS

- A. The Drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.6 SUBMITTALS

- A. Refer to General Conditions for submittal requirements, in addition to requirements specified herein.
- B. Submittals and shop drawings shall not contain Henderson Engineer's firm name or logo, nor shall they contain the Henderson Engineer's seal and signature. They shall not be copies of Henderson Engineer's work product. If the Contractor desires to use elements of such product, the license agreement for transfer of information at the end of this section must be used.
- C. Assemble and submit for review manufacturer product literature for material and equipment to be furnished and/or installed under this Division. Literature shall include shop drawings, manufacturer product data, performance sheets, samples, and other submittals required by this Division. Provide the number of submittals required; if hard-copy sets are provided, submit a minimum of seven (7) sets. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- D. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.
- E. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Illegible submittals will be rejected and returned without review.
- F. Refer to individual sections for additional submittal requirements.
- G. Transmit submittals as early as required to support the project schedule. Allow two weeks for Engineer review time, plus to/from mailing time via the Contract Administrator, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before electrical construction starts.

- H. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- I. Submittals shall contain the following information:
 - 1. The project name.
 - 2. The applicable specification section and paragraph.
 - 3. Equipment identification acronym as used on the drawings.
 - 4. The submittal date.
 - 5. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
 - 6. Submittals not so identified will be returned to the Contractor without action.
- J. For electronic submittals, Contractor shall submit the documents in accordance with this Section. Contractor shall notify the Contract Administrator and Engineer that the submittals have been posted. Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Contractor Administrator's and Engineer's designated representatives. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the submittal.
- K. The checking and subsequent acceptance by the Engineer and/or Contract Administrator of submittals shall not relieve responsibility from the Contractor for (1) deviations from the Drawings and Specifications; (2) errors in dimensions, details, sizes of equipment, or quantities; (3) omissions of components or fittings; and (4) not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Engineer and Contract Administrator prior to implementing any deviation.

1.7 SUBSTITUTIONS

- A. Refer to General Conditions for substitutions in addition to requirements specified herein.
- B. Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.
- C. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.
- D. Request for Substitution:
 - 1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.
 - 2. The burden of proof of the merit of the proposed substitution is upon the proposer.
 - 3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
 - a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
 - b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
 - c. Proposed substitution has received necessary approvals of the Authorities Having Jurisdiction.
 - d. Same warranty will be furnished for proposed substitution as for specified Work.

- e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
- f. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

E. Substitution Consideration:

- 1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.
- 2. No substitutions will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.
- 3. If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other manner. Verbal approval will not be given.
- 4. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.8 QUALITY ASSURANCE

- A. Execute all work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the work specified.
- B. Install all work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.
- C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.
- D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.9 OPERATION AND MAINTENANCE MANUALS

- A. Refer to General Conditions for Operation and Maintenance Manuals in addition to requirements specified herein.
- B. Submit manuals prior to requesting the final punch list and before all requests for Substantial Completion.
- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Prior to Substantial Completion of the project, furnish to the Contract Administrator, for Engineer's review, and for the Owner's use, four (4) copies of Operation and Maintenance Manuals in labeled, hard-back three-ring binders, with cover, binding label, tabbed dividers and plastic insert folders for Record Drawings. Include local contacts, complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

- E. Each manual shall contain equipment data, approved submittals, shop drawings, diagrams, capacities, spare part numbers, manufacturer service and maintenance data, warranties and guarantees.
- F. For electronic manuals, Contractor shall submit the documents in accordance with this Section. Contractor shall notify the Contract Administrator and Engineer that the manuals have been posted. Contractor shall include the website, user name and password information needed to access the manuals. For manuals sent by e-mail, Contractor shall copy the Contract Administrator's and Engineer's designated representatives.

1.10 SPARE PARTS

- A. Provide to the Owner the spare parts specified in the individual sections of this Division

1.11 RECORD DRAWINGS

- A. Refer to General Conditions for Record Drawings in addition to requirements specified herein.
- B. A set of work prints of the Contract Documents shall be kept on the jobsite during construction for the purpose of noting changes. During the course of construction, the Contractor shall indicate on these Documents changes made from the original Contract Documents. Particular attention shall be paid to those items which need to be located for servicing. Underground utilities shall be located by dimension from column lines.
- C. At the completion of the project, the Contractor shall obtain, at their expense, reproducible copies of the final drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done by a skilled drafter. Each sheet shall be marked "Record Drawing", along with the date. These drawings shall be delivered to the Contract Administrator.

1.12 DELIVERY, STORAGE AND HANDLING

- A. Refer to General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.
- B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Contract Administrator.
- D. Be responsible for the safe storage of tools, material and equipment.

1.13 WARRANTIES

- A. Refer to General Conditions for Warranties in addition to requirements specified herein.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

- C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions.
- D. Also warrant the following additional items:
 - 1. All raceways are free from obstructions, holes, crushing, or breaks of any nature.
 - 2. All raceway seals are effective.
 - 3. The entire electrical system is free from all short circuits and unwanted open circuits and grounds.
- E. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
- F. Perform the remedial work promptly, upon written notice from the Contract Administrator or Owner.
- G. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.14 TEMPORARY FACILITIES

- A. Refer to General Conditions for Temporary Facilities requirements in addition to requirements specified herein.
- B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
- C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.
 - 1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
 - 2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

1.15 FIELD CONDITIONS

- A. Conditions Affecting Work In Existing Buildings: The following project conditions apply:
 - 1. The Drawings describe the general nature of remodeling to the existing building; however, visit the site prior to submitting bid to determine the nature and extent of work involved.
 - 2. Schedule work in the existing building with the Owner.

3. Perform certain demolition work prior to the remodeling. Perform the demolition that involves electrical systems, Light fixtures, equipment, raceways, equipment supports or foundations and materials.
 4. Remove articles that are not required for the new work. Unless otherwise indicated, remove each item removed during this demolition from the premises and dispose in accordance with applicable federal, state and local regulations.
 5. Relocate and reconnect electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where electrical equipment or materials are removed, cap unused raceways below the floor line or behind the wall line to facilitate restoration of finish.
 6. Finish material will be installed under other divisions.
 7. Obtain permission from the Contract Administrator for channeling of floors or walls not specifically noted on the Drawings.
 8. Protect adjacent materials indicated to remain. For work specific to this Division, install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 9. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, provide temporary services for affected areas.
- B. Conditions Affecting Excavations: The following project conditions apply:
1. Maintain and protect existing building services that transit the area affected by selective demolition.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
- C. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
- D. Use of explosives is not permitted.
- E. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS AND MATERIALS

(Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 EXISTING CONDITIONS

- A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and, they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new work.

- B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

3.3 EXISTING UTILITIES

- A. Prepare and submit a schedule of anticipated utility outages indicating dates and duration.
Schedule
- B. Schedule and coordinate with the utility companies, Owner and with the Contract Administrator all connections to, relocation of, or discontinuation of normal utility services from any existing utility line. Include all premium time required for all such work in the bid.
- C. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or utility companies without additional cost.
- D. Do not leave utilities disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Contract Administrator.
- E. Make repairs and restoration of utilities before workers leave the project at the end of the workday in which the interruption takes place.
- F. Include in bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

3.4 WORK IN EXISTING FACILITIES

- A. The Drawings describe the general nature of remodeling to the existing facilities; however, visit the site prior to submitting a bid, to determine the nature and extent of work involved.
- B. Schedule work in the existing facility with the Owner.
- C. Certain demolition work shall be performed prior to the remodeling. Perform the demolition that involves electrical systems, fixtures, conduit, wiring, equipment, equipment supports or foundations and materials.
- D. Remove all of these articles that are not required for the new work. Unless otherwise indicated, each item removed during this demolition shall be removed from the premises and disposed of in accordance with all state and local regulations.
- E. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Contract Administrator and the Owner no fewer than 7 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Contract Administrator and the Owner's written permission.
 - 3. Owner reserves the right to require Contractor to cease work in any area Owner requires access to on an emergency basis.
- F. Relocate and reconnect all electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where electrical fixtures or equipment are removed, cap all unused raceways behind the floor line or wall line to facilitate restoration of finish, and, remove all existing wiring from abandoned raceways.
- G. Finish materials are specified in other divisions.
- H. Where removal of existing wiring interrupts electrical continuity of circuits that are to remain in use, provide necessary wiring, raceways, junction boxes, etc., to ensure continued electrical continuity.

- I. Channel walls and floors as required to produce the desired result; however, obtain permission from the Contract Administrator for all channeling not specifically noted on the Drawings.
- J. Provide new, typewritten card directory for distribution equipment (including but not limited to load centers, panelboards, switchboards and switchgear) where changes occur under this scope of work. Indicate exact loads served by each existing circuit breaker or switch.

3.5 PERMITS

- A. Secure and pay for all permits required in connection with the installation of the Electrical Work. Arrange with the various utility companies for the installation and connection of all required utilities for this facility and pay all charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others.

3.6 TEMPORARY ELECTRICAL SERVICE AND WIRING

- A. Provide 208Y/120 volt, three-phase, four-wire, temporary electrical service and temporary lighting system to facilitate construction.
- B. In existing facilities, with Owner's approval, Contractor may utilize the existing electrical system as the source of temporary power. Coordinate the point of connection and method of connection to the existing system with the Owner's Representative.
- C. The Owner will pay all charges made by the Electrical Utility, with respect to installation and energy charges for temporary services.
- D. Work for the temporary power shall consist of all labor and materials, including, but not limited to conduit, wiring, panelboards, fuse blocks, fused disconnecting switches, fuses, pigtails, receptacles, wood panel switch supports, metering, and other miscellaneous materials required to complete the power system.
- E. Install all temporary wiring in accordance with applicable codes, and maintain in an OSHA-approved manner.
- F. Provide an adequate number of GFCI type power distribution centers, rated 208Y/120V, four-wire, and not less than 60A, with sufficient fuse blocks or breakers for lighting and hand tool circuits, 60A four-wire feeders, all mounted within pre-fabricated enclosures UL listed for this application or on suitable wood panels bolted to columns or upright wood supports as required.
- G. Install circuits to points on each level of each building so that service outlets can be reached by a 50-foot extension cord for 120V power and a 100-foot extension cord for 208V power (or as required by OSHA or local authorities).
- H. Provide one lighting outlet per 30 linear feet of corridor and at least one light in each room and for every 800 square feet of floor area. Temporary lighting shall comply with OSHA requirements.
- I. If additional service is required for cranes, electrical welders or for electric motors over 1/2 HP per unit, such additional service shall become the responsibility of the trade involved.
- J. When the permanent wiring for lighting and power is installed, with approval of the Contract Administrator and Owner, the permanent system may be used, provided the Contractor assumes full responsibility for all electrical material, equipment, and devices contained in the systems and provided that roof drainage system and roofing are complete.
- K. When directed by the Contract Administrator, remove all temporary services, lighting, wiring and devices from the property.

3.7 SELECTIVE DEMOLITION

- A. Refer to Division 02, and General Conditions for Selective Demolition requirements in addition to the requirements specified herein.

- B. General: Demolish, remove, demount, and disconnect abandoned electrical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- C. Materials and Equipment To Be Salvaged: remove, demount, disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- D. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- E. Electrical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete raceways, fittings, supports and specialties, equipment, wiring, controls, fixtures, and insulation:
 - a. Raceways and outlets embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Cut embedded raceways to below finished surfaces, seal, and refinish surfaces as specified or as indicated on the Architectural Finish Drawings. Remove materials above accessible ceilings. Cap raceways allowed to remain.
 - b. Perform cutting and patching required for demolition in accordance with, General Conditions and "Cutting and Patching" portion of this Section in Division 26.

3.8 ACCESS TO EQUIPMENT

- A. Locate all pull boxes, junction boxes and controls so as to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings. Refer to Division 26 Section "Common Work Results for Electrical".
- B. Maintain all code required clearances and clearances required by manufacturers.

3.9 PENETRATIONS

- A. Unless otherwise noted as being provided under other divisions, provide sleeves, box frames, or both, for openings in floors, walls, partitions and ceilings for all electrical work that passes through construction. Refer to Division 26 Section "Common Work Results for Electrical".
- B. Provide sleeves, box frames, or both, for all conduit, cable, and busways that pass through masonry, concrete or block walls.
- C. The cutting of new and/or existing construction will not be permitted except by written approval of the Contract Administrator.

3.10 EXCAVATION AND BACKFILLING

- A. Refer to Division 02 and General Conditions for Excavation and Backfilling in addition to the requirements specified herein.
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.
- C. Restore roads, alleys, streets and sidewalks damaged during this work to the satisfaction of Authorities Having Jurisdiction.
- D. Do not excavate trenches close to walks or columns without prior consultation with the Contract Administrator.

- E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep those burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.
- F. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.
- I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- K. Excavation for Underground Tanks and Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 - 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of one inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- L. Trenching: Excavate trenches for electrical installations as follows:
 - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.
 - 2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 - 3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
 - 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.
 - 5. Excavate trenches for raceway, cables, and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.

- M. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- N. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
 - 1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 - 2. Under building slabs, use drainage fill materials.
 - 3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 - 4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 - 5. Other areas use excavated or borrowed materials.
- O. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 - 2. Removal of concrete formwork.
 - 3. Removal of shoring and bracing, and backfilling of voids.
 - 4. Removal of trash and debris.
- P. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
 - 1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less that 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.
- Q. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- R. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- S. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
 - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

- c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
- 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- T. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.11 CUTTING AND PATCHING

- A. Provide all necessary cutting of walls, floors, ceilings and roofs for work under this Division.
- B. Cut no structural member without permission from Contract Administrator.
- C. Patch around all openings to match adjacent construction.
- D. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Contract Administrator.

3.12 PAINTING

- A. Refer to Division 09 Section "Painting" for painting requirements.
- B. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under individual sections and Division 09 of the Specifications; colors shall be as selected by the Contract Administrator.
- C. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
- D. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.
- E. Where factory finishes are provided and no additional field painting is specified, touch up or refinish, as required by, and to the acceptance of, the Contract Administrator, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Contract Administrator, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.

3.13 CLEANING

- A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.
- B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from the Work and assist in making the premises broom clean. Clean all material and equipment installed under this Division.
- C. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.
- D. Touch up and restore damaged finishes to their original condition.

3.14 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align and test all electrical equipment furnished and/or installed under this Division.
- B. Check motors for alignment with drive and proper rotation, and adjust as required.
- C. Check and test protective devices for specified and required application, and adjust as required.
- D. Check, test and adjust adjustable parts of all light fixtures and electrical equipment as required to produce the intended performance.
- E. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.
- F. After completion, perform tests for continuity, unwanted grounds, and insulation resistance in accordance with the requirements of NFPA 70 and NETA.
- G. Be responsible for the operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Owner of the complete project under this Contract. Maintain all electrical equipment in the best operating condition including proper lubrication.
- H. Notify the Contract Administrator immediately of all operational failures caused by defective material, labor or both.
- I. Maintain service and equipment for all testing of electrical equipment and systems until all work is approved and accepted by the Owner.
- J. Keep a calibrated voltmeter and ammeter (true RMS type) available at all times. Provide service for test readings when and as required.
- K. Refer to individual sections for additional and specific requirements.

3.15 START-UP OF SYSTEMS

- A. Prior to start-up of electrical systems, check all components and devices, lubricate items appropriately, and tighten all screwed and bolted connections to manufacturers' recommended torque values using appropriate torque tools.
- B. Each power, lighting and control circuit shall be energized, tested and proved free of breaks, short-circuits and unwanted grounds.
- C. Adjust taps on each transformer for rated secondary voltages.
- D. Balance all single phase loads at each panelboard, redistributing branch circuit connections until balance is achieved to plus or minus 10 percent.
- E. Replace all burned-out lamps. Replace the lamps of all light fixtures that use incandescent, halogen or quartz lamp sources that are installed as part of the finished building, but are used by the Contractor during construction, with new lamps of appropriate type and wattage prior to turning the facility over to the Owner.
- F. After all systems have been inspected and adjusted, confirm all operating features required by the Drawings and Specifications and make final adjustments as necessary.
- G. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.
- H. At the time of final review and tests of the power and lighting systems, all equipment and system components shall be in place and all connections at panelboards, switches, circuit breakers, and the like, shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connections to all switches, receptacles, outlets, and the like.

3.16 TEST REPORTS

- A. Perform tests as required by these Specifications and submit the results in the operations and maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each electrical system installed. Notify the Contract Administrator and Engineer two working days prior to each test.
- B. For specific testing requirements of special systems, refer to the Specification section that describes that system.
- C. Upon completing each test, record the results, date and time of each test and the conditions under which the test was conducted. Submit to the Contract Administrator, for Engineer's review, in duplicate, the test results for the following electrical items:
 - 1. Building service entrance voltage and amperes at each phase.
 - 2. Electrical service grounding conditions and grounding resistance.
 - 3. Proper phasing throughout the entire system.
 - 4. Voltages (phase-to-phase and phase-to-neutral) and amperes at each phase for each panelboard, switchboard, and the like.
 - 5. Phase voltages and amperes at each three-phase motor.
 - 6. Test all wiring devices for electrical continuity and proper polarity of connections.
- D. Promptly correct all failures or deficiencies revealed by these tests as determined by the Engineer.

3.17 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:
 - 1. Submit complete Operation and Maintenance Data.
 - 2. Submit complete Record Drawings.
 - 3. Perform all required training of Owner's personnel.
 - 4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
 - 5. Perform start-up tests of all systems.
 - 6. Remove all temporary facilities from the site.
 - 7. Comply with all requirements for Substantial Completion in the General Conditions.
- B. Request in writing a review for Substantial Completion. Give the Contract Administrator at least seven (7) days notice prior to the review.
- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Contract Administrator will either proceed with the review or advise the Contractor of unfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, he shall reimburse the Contract Administrator and Engineer for time and expenses incurred for the visit.
- F. Upon completion of the review, the Contract Administrator will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section includes limited scope general construction materials and methods, electrical equipment coordination, and common electrical installation requirements as follows:
 - 1. Access doors in walls, ceilings, and floors for access to electrical materials and equipment.
 - 2. Sleeves and seals for electrical penetrations.
 - 3. Joint sealers for sealing around electrical materials and equipment, and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

1.2 DEFINITIONS

- A. The following abbreviations apply to this and other Sections of these Specifications:
 - 1. AHJ: Authority(ies) having Jurisdiction
 - 2. ATS: Acceptance Testing Specifications
 - 3. EPDM: Ethylene-propylene-diene monomer rubber
 - 4. MC: Metal Clad
 - 5. NBR: Acrylonitrile-butadiene rubber
 - 6. NRTL: Nationally Recognized Testing Laboratory
 - 7. PCF: Pounds per Cubic Foot
- B. The following definitions apply to this and other Sections of these Specifications:
 - 1. Homerun: That portion of an electrical circuit originating at a junction box, termination box, receptacle or switch with termination at an electrical panelboard. Note: Where MC Cable is utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box in an accessible ceiling space immediately above the first load.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.
 - 4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Division 26 Section "General Electrical Requirements":
 - 1. Product data for the following products:
 - a. Sleeve seals.
 - b. Through and membrane penetration firestopping systems.
 - c. Joint sealers

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.2 SLEEVES

- A. Steel sleeves for raceways and cables
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends and drip rings.
- B. Cast iron wall pipe sleeves for raceways and cables
 - 1. Manufacturers
 - a. Josam Mfg. Co.
 - b. Smith (Jay R) Mfg. Co.
 - c. Tyler Pipe/Wade Div.; Subs of Tyler Corp.
 - d. Watts Industries, Inc.
 - e. Zurn Industries, Inc.; Hydromechanics Div.
 - 2. Cast-iron sleeve with integral clamping flange with clamping ring, and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with setscrews.
 - 3. Sleeves for rectangular openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
 - 4. Coordinate sleeve selection and application with selection and application of firestopping to be used.

2.3 SEALANTS

- A. SLEEVE SEALS
 - 1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 2. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.

- d. O-Z/Gedney
 - e. Pipeline Seal and Insulator, Inc.
3. Sealing Elements: Interlocking or solid sealing links shaped or pre-drilled to fit surface of cable or raceway. Include type and number required for material and size of raceway or cable.
- a. EPDM
 - b. NBR
 - c. Neoprene
4. Pressure Plates: Include two for each sealing element. For multi-phase circuits, use slotted pressure plates if metal.
- a. Plastic
 - b. Carbon steel
 - c. Stainless steel
 - d. PVC-coated steel
5. Connecting Bolts and Nuts: of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- a. Carbon steel with corrosion-resistant coating
 - b. Stainless steel

B. JOINT SEALERS

1. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
2. Colors: As selected by the Contract Administrator from manufacturer's standard colors.
3. Elastomeric Joint Sealers: Provide the following types:
- a. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 - b. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
 - c. Products: Subject to compliance with requirements, provide one of the following:
 - 1) One-Part, Nonacid-Curing, Silicone Sealant:
 - a) "Dow Corning 790," Dow Corning Corp.
 - b) "Dow Corning 795," Dow Corning Corp.
 - c) "Silglaze N SCS 2801," General Electric Co.
 - d) "Silpruf SCS 2000," General Electric Co.
 - e) "864," Pecora Corp.
 - f) ".Omniseal," Sonneborn Building Products Div
 - g) "Spectrem 1," Tremco, Inc.
 - h) "Spectrem 2," Tremco, Inc.
 - 2) One-Part, Mildew-Resistant, Silicone Sealant:
 - a) "Dow Corning 786," Dow Corning Corp.
 - b) "Sanitary 1700," General Electric Co.
 - c) "898 Silicone Sanitary Sealant," Pecora Corp.
 - d) "OmniPlus," Sonneborn Building Products Div.
 - e) "Tremsil 600 White," Tremco Corp.

4. Acrylic-Emulsion Sealants: One-part, non-sagging, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) "Chem-Calk 600," Bostik
 - 2) "AC-20," Pecora Corp.
 - 3) "Sonolac," Sonneborn Building Products Div.
 - 4) "Tremflex 834," Tremco, Inc.

C. FIRESTOPPING

1. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, by Underwriters' Laboratories, Inc., or other NRTL acceptable to AHJ.
 - a. Manufacturers:
 - 1) Hilti, Inc.
 - 2) RectorSeal.
 - 3) Specified Technologies Inc.
 - 4) 3M Corp.
 - 5) United States Gypsum Company.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".
- C. Coordinate seals with wall, ceiling, roof or floor materials and rating of the surface (sound, fire, waterproofing, etc.)
- D. Comply with NECA 1.
- E. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless indicated otherwise.
- F. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- H. Right of Way: Yield to raceways and piping systems installed at a required slope.

3.2 SLEEVES AND SLEEVE SEALS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Provide sleeves for required openings in all concrete and masonry construction and fire, smoke, or both, partitions, for all electrical work that passes through such construction. Coordinate with all other trades and divisions to dimension and lay out all such openings.

- C. Only those openings specifically indicated on the Architectural or Structural Drawings will be provided under other divisions.
- D. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Do not cut or core drill new construction without written approval from the Contract Administrator and Structural Engineer.
- E. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- F. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- G. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- H. Install pipe and rectangular sleeves in above-grade walls and slabs, where penetrations are not subject to hydrostatic water pressures. Ensure that drip ring is fully encased and sealed within the wall or slab.
- I. Cut sleeves to length for mounting flush with both surfaces of walls.
- J. Extend sleeves installed in floors 2 inches above finished floor level.
- K. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed; in which case, size sleeves as recommended by the seal manufacturer.
- L. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- M. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
- N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (or larger, if required by the seal manufacturer) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Above Grade Concrete or Masonry Penetrations
 - 1. Provide sleeves for cables or raceways passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide sleeves as follows:
 - a. Install schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.
 - b. Install galvanized sheet metal for sleeves 6 inches in diameter and larger, thickness shall be 0.138 inches.
 - c. Install galvanized sheet metal for rectangular sleeves
 - d. Schedule 40 PVC pipe sleeves are acceptable for use in areas without return air plenums.
 - 2. Seal elevated floor, exterior wall and roof penetrations watertight and weather tight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2" of sealant.
- P. Underground, Exterior-Wall Penetrations: Install cast-iron wall pipes for sleeves. Size sleeves to allow for 1-inch (or larger, if required by the mechanical sleeve manufacturer) annular clear space between sleeve and cable or raceway. Provide mechanical sleeve seal.

1. Use type and number of sealing elements recommended by manufacturer for pipe material and size. Position pipe in center of sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 2. Inspect installed sleeve and sleeve-seal installation for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade to seal against hydrostatic pressure.
- Q. Exterior Wall Penetrations: Seal annular space between sleeve and raceway or duct, using joint sealant for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of ½" of waterproof sealant.
- R. Sleeve-Seal Installation
1. Install sleeve seals for all underground raceway penetrations through walls at elevations below finished grade. Additionally, install seals inside raceways, after conductors or cables have been installed, in all raceway penetrations through walls at elevations below finished grade.
 2. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Inspect installed sleeve and sleeve-seal installations for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade and above grade where installed to seal against hydrostatic pressure.

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire/smoke-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.4 JOINT SEALERS

- A. Preparation for Joint Sealers
1. Clean surfaces of penetrations, sleeves, or both, immediately before applying joint sealers, to comply with recommendations of joint sealer manufacturer.
 2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.
- B. Application of Joint Sealers
1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - a. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - b. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.
 2. Tooling: Immediately after sealant application and prior to time shining or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical raceways penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which

penetration occurs. Comply with installation requirements established by testing and inspecting agency.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Conductors, cables, and cords rated 600V and less.
 - 2. Connectors and terminations rated 600V and less.

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- B. Division 26 Section "Common Work Results for Electrical" for sleeves and seals for electrical penetrations.
- C. Division 26 Section "Grounding and Bonding for Electrical Systems" for conductors and connectors for grounding systems.
- D. Division 26 Section "Equipment Wiring Systems" for electrical connections to equipment specified under other Sections, Divisions, or furnished by the Owner.
 - 1. Division 28 Section "Digital, Addressable Fire-Alarm System" for fire alarm wiring.
- E. Division 23 Section "Direct-Digital Control for HVAC" for temperature control wiring.

1.3 SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field Quality-Control Test Reports: From Contractor.

1.4 ABBREVIATIONS AND DEFINITIONS

- A. The following abbreviations apply to this and other Sections of these specifications:
 - 1. NBR: Acrylonitrile-butadiene rubber
- B. The following definitions apply to this and other Sections of these Specifications:
 - 1. HOMERUN: That portion of an electrical circuit beginning at a junction box, termination box, receptacle or switch with termination at an electrical panelboard. Note: Where MC Cable is allowed to be utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box in an accessible ceiling space immediately above the first (most upstream) load.

1.5 QUALITY ASSURANCE

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."
- C. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to AHJ.
 2. Marked for intended use.
- D. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.2 CONDUCTORS AND CABLES

- A. General
1. Manufacturers:
 - a. AFC Cable Systems, Inc.
 - b. Alan Wire
 - c. Cerrowire
 - d. Colonial Wire & Cable
 - e. Encore Wire Corporation
 - f. General Cable
 - g. Northern Cables Inc.
 - h. Okonite Company
 - i. Southwire Company
 2. Conductor Material: Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL Standards 44 or 83, as applicable; solid conductor for No. 10 AWG and smaller; concentric, compressed stranded for No. 8 AWG and larger and stranded for all flexible cords, cables, and control wiring.
 3. Conductor Insulation Types: Type THW, THHN/THWN-2 and/or XHHW-2 complying with ICEA S-95-658/NEMA WC70.
 4. Sizes of conductors and cables indicated or specified are American Wire Gage (Brown and Sharpe).
 5. Unless indicated otherwise, special purpose conductors and cables, such as low voltage control and shielded instrument wiring, shall be as recommended by the system equipment manufacturer.
 6. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- B. Single Conductors
1. 600V, THW-, THHN/THWN-2 and/or XHHW-insulated conductors, color-coded as follows:

PHASE 208Y/120V

A	Black
B	Red
C	Blue
Neutral	White
Equipment Ground	Green

2. Where local amendments dictate color-coding of conductors, local amendments shall supersede these color-coding requirements.
3. Conductors shall not be smaller than No. 12 AWG, except that wiring for signal and pilot control circuits and pre-manufactured whips for light fixtures may be No. 14 AWG.

C. Control Wiring

1. Refer to Division 23 Section "Direct-Digital Control for HVAC"
2. Unless otherwise noted, all control wiring will be the responsibility of the Section or Division in which the control system is specified.

D. Connectors

1. Manufacturers:
 - a. AMP; Tyco
 - b. FCI-Burndy
 - c. Gould
 - d. Ideal Industries, Inc.
 - e. IlSCO
 - f. NSi Industries, Inc.
 - g. O-Z/Gedney
 - h. Panduit
 - i. Thomas and Betts
 - j. 3-M Electrical Products Division
2. Compression connectors for conductors No. 8 AWG and larger: Long-barreled, UL 486-listed, tinned copper, circumferential compression type (Burndy "Hylug", or equal), insulated with clamp-on, cold-shrink, or molded covers, or wrapped with multiple overlapping layers of 3-M Scotch electrical tape.
 - a. Termination fittings: 1-hole pad and inspection port.
3. Mechanical connections for conductors No. 8 AWG and larger: UL-listed, tinned copper and/or tinned aluminum, dual-rated, mechanical type, insulated with clamp-on, cold-shrink, or molded covers, or wrapped with multiple overlapping layers of 3-M Scotch electrical tape.
 - a. Termination fittings: 1-hole pad and inspection port.
4. Connectors for solid conductors No. 10 AWG and smaller: Insulated winged wire nuts. Color-coded for size, except use green only for grounding connections.
5. Connectors for stranded conductors No. 10 AWG and smaller: Tinned copper, insulated-sleeve, compression type, UL-listed, with wire insulation grip. Terminations: flanged fork-tongue type.
6. Connectors and terminations for aluminum conductors and cables No. 1 and larger: UL 486B listed and marked AL7CU for 75 deg C rated conductors and AL9CU for 90 deg C rated conductors.

PART 3 - EXECUTION

3.1 CONDUCTORS AND CABLES

A. General:

1. Unless otherwise indicated on the Drawings or in other Sections, install all conductors in raceway. Install continuous conductors between outlets, devices and boxes without splices or taps. Do not pull connections into raceways. Leave at least 8 inches of conductor at outlets for fixture or device connections.
2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used shall not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
3. Use pulling means, including fish tape, cable, rope, and basket weave conductor/cable grips that will not damage conductors/cables or raceway.
4. Electrical conductor and cable work is schematically represented on the Drawings. Unless otherwise indicated, conductor sizes shown on the Drawings are based on not more than three single current-carrying conductors in a raceway in free air. Current ratings are based on copper at 75 degrees C temperature rating for all power circuits. Modify raceway and conductor sizing as may be necessitated by any deviation from these conditions. Do not decrease the indicated conductor size due to the use of conductors having a temperature rating of 90 degrees C.
5. Conductor sizes shown are minimum based on code requirements, voltage drop, and/or other considerations. Where approved by the Engineer and at no extra cost to the Owner, larger conductor sizes may be installed at Contractor's option in order to utilize stock sizes, provided raceway sizes are increased where necessary to conform with NFPA 70 (determine the effect of the use of larger conductors on the short circuit current ratings of the electrical equipment, and provide increased short circuit current rated equipment as required).
6. Where parallel conductors are shown, install each set of conductors in separate raceways of essentially the same length.
7. Seal around cables penetrating fire-rated elements according to Division 07 Section "Penetration Firestopping".
8. Identify conductors and cables according to Division 26 Section "Identification for Electrical Systems". Color code shall be factory applied heat shrink, no cold applied.
9. Wiring at Outlets: Install conductors at each outlet with at least 6 inches of slack.
10. Common or Shared Neutrals are not allowed unless shown on the plans or specifically noted to be allowed.
11. Multi-wire branch circuits (i.e., shared neutral) shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point the branch circuit originates. Multi-pole breakers or 3 single pole breakers with a handle tie are two example
12. When multiple homeruns are combined into a single raceway such that the number of conductors exceeds four (conductor count is made up of any combination of phase and neutral conductors), the following restrictions apply, which are in addition to those in NFPA 70:
 - a. Normal or Non-Essential circuits.
 - 1) Maximum of 16 conductors in a single raceway. For up to eight conductors in a raceway, minimum raceway size: 3/4 inch. For greater than eight conductors, minimum raceway size: 1 inch. Do not install any other type of circuit in this raceway.
 - 2) The minimum wire size for all conductors in this raceway: No. 10 AWG.
 - 3) Only 15A and 20A branch circuit homeruns may be combined into one raceway.
 - b. GFCI-protected circuits.

- 1) Do not use multi-conductor circuits, with a shared neutral, for any GFCI circuit breaker or receptacle circuit.
 13. For branch circuits fed from GFCI circuit breakers, limit the one-way conductor length to 100 feet between the panelboard and the most remote receptacle or load on the GFCI circuit.
 14. Where the number of conductors for branch circuits is not shown on the Drawings, determine the number of conductors in accordance with NFPA 70. Provide adequate conductors so as to allow performance of all functions of the device.
 15. Provide all conductors with 600V insulation of the following types, unless otherwise noted on the Drawings or in these Specifications:
 - a. Wet or dry locations, in raceways:
 - 1) Service entrance: Type THWN, THHN/THWN-2, or XHHW.
 - 2) Feeders and branch circuits: Type THWN, THHN/THWN-2, or XHHW.
 - 3) Conductors No. 6 AWG and smaller: Types THWN or THHN/THWN-2.
 - b. Conductors within three feet of high temperature equipment such as heaters: Type THHN, XHHW, or higher temperature insulation as required for the use.
- B. Control Wiring
1. Unless otherwise indicated on the Drawings or in other sections, install all control wiring in raceway, regardless of voltage. A qualified Electrician shall install all control wire operating at 120V nominal and above. Control wiring operating at less than 120V (e.g., 12V and 24V) may be installed under the Division furnishing it.
 2. Open wiring in air-handling plenums: UL listed and classified for use in air plenums without raceway. Where indicated on the Drawings or specified, and permitted by local codes, only cable for communication or fire alarm systems and low voltage control wiring may be installed without raceways.
- C. Connections:
1. Apply a zinc based, anti-oxidizing compound to connections.
 2. 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 and UL 486B.
 3. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 4. Use only resin pressure splices and splicing kits that totally encapsulate the splice for splices in underground junction boxes. Arrange the splicing kit to minimize the effects of moisture.
 5. Connect conductors No. 6 AWG and larger to panelboards and apparatus by means of approved mechanical lugs or compression connectors.
 6. Do not use terminals on wiring devices to feed through to the next device.

3.2 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements. Test all wiring prior to energizing to ensure that it is free from unintentional grounds and shorts, is properly phased, and that all connectors are tight.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
1. Test procedures used.

2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. This Section includes:
 - 1. Grounding Conductors
 - 2. Connector Products
 - 3. Grounding Electrodes
 - 4. Ground Bars
 - 5. Miscellaneous Grounding Materials and Products

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this section.
- B. Division 26 Section "Low-voltage Electrical Power Conductors and Cables" for insulated conductors.
- C. Division 26 Section "Raceway and Boxes for Electrical Systems" for raceways.
- D. Division 26 Section "Lightning Protection for Structures" for additional grounding and bonding materials.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Division 26 Section "General Electrical Requirements":
 - 1. Product data for the following products:
 - a. Electrodes, mechanical and compression connectors, and exothermic connectors .
- B. Field Quality-Control Test Reports: From Contractor.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Record Drawings: Submit Record Drawings as required by Division 26 Section "General Electrical Requirements":
 - 1. Accurately record actual locations of all exterior buried electrodes and all buried ground rings. Indicate dimensions from fixed structural elements.

1.4 DEFINITIONS

- A. The following apply to this and other Sections of these Specifications:
 - 1. EMT: Electrical metallic tubing.
 - 2. ENT: Electrical nonmetallic tubing.
 - 3. FMC: Flexible metal conduit.

4. IMC: Intermediate metal conduit.
5. LFMC: Liquidtight flexible metal conduit.
6. LFNC: Liquidtight flexible nonmetallic conduit.
7. RMC: Rigid Metal Conduit
8. GRS: Galvanized Rigid Steel Conduit
9. RAC: Rigid Aluminum Conduit
10. RNC: Rigid nonmetallic conduit.
11. PSF: Pounds per Square Foot

1.5 QUALITY ASSURANCE

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Test Equipment Suitability and Calibration: Comply with NETA ATS (current version), "Suitability of Test Equipment" and "Test Instrument Calibration."
- C. Electrical Components, Devices, and Accessories:
 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 2. Marked for intended use.
 3. Comply with UL 467.
- D. Comply with NFPA 70; for medium-voltage underground construction, comply with IEEE C2.
- E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- F. Comply with NFPA 70.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.2 GROUNDING CONDUCTORS, CONNECTORS, AND ELECTRODES:

- A. Manufacturers:
 1. Apache Grounding/Erico Inc.
 2. Boggs, Inc.
 3. Chance/Hubbell.
 4. Copperweld Corp.
 5. Dossert Corp.
 6. Erico Inc.; Electrical Products Group.
 7. FCI/Burndy Electrical.
 8. Galvan Industries, Inc.
 9. Harger Lightning Protection, Inc.
 10. Hastings Fiber Glass Products, Inc.
 11. Heary Brothers Lightning Protection Co.
 12. Ideal Industries, Inc.

13. ILSCO.
14. Kearney/Cooper Power Systems.
15. Korns: C. C. Korns Co.; Division of Robroy Industries.
16. Lightning Master Corp.
17. Lyncole XIT Grounding.
18. O-Z/Gedney Co.; a business of the EGS Electrical Group.
19. Panduit, Inc
20. Raco, Inc.; Division of Hubbell.
21. Robbins Lightning, Inc.
22. Salisbury: W. H. Salisbury & Co.
23. Superior Grounding Systems, Inc.
24. Thomas & Betts, Electrical.

2.3 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Common Work Results for Electrical."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Bare, stranded, unless otherwise indicated.
- E. Underground Conductors: Bare-copper conductor, No. 2/0 AWG minimum stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
 1. Solid Conductors: ASTM B 3.
 2. Assembly of Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (wide and 1/16 inch thick.
- H. Ground Conductor and Conductor Protector for Wood Poles: As follows:
 1. No. 4 AWG minimum, soft-drawn copper conductor.
 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.
- I. Grounding Bus: UL & cUL Listed to UL467 & C22.2 respectively, pre-drilled, bare, 1/4 inch thick, electrolytic, tough pitch copper bar, length and width as indicated on the Drawings; insulators and standoffs as specified in Paragraph "Ground Bars" below.

2.4 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors
 1. Compression Connectors: Burndy Hyground, or equal, permanent, pure, wrought copper, meeting ASTM 8 1 87, essentially the same as the conductors being connected; clearly and permanently marked with the information listed below:

- a. Company symbol and/or logo.
 - b. Catalog number.
 - c. Conductors accommodated.
 - d. Installation die index number or die catalog number is required.
 - e. Underwriters Laboratories "Listing Mark:".
 - f. The words "Suitable for Direct Burial" or, where space is limited, "Direct Burial" or "Burial" per UL Standard ANSI/UL467 (latest revision).
2. Cast connectors: copper base alloy according to ASTM B 30 (latest revision).
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: UL-listed:
1. Copper-clad steel; bonded copper electrolytically-applied to minimum thickness of 10 mils.
 2. Hot-dip galvanized steel; minimum zinc thickness specified per ASTM A-123
 3. Stainless steel; Type 304
 4. Size: 5/8 inch by 8 feet. Provide sectional types when longer rods are indicated.

2.6 GROUND BARS

- A. Rectangular Ground Bars: UL & cUL Listed to UL467 & C22.2 respectively, pre-drilled, bare, 1/4 inch thick, electrolytic, tough pitch copper bar, length and width as indicated on the Drawings.
- B. Supports: Minimum of two each 1-1/2-inch insulators and 1-inch stainless steel offset mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which electrical grounding connections are to be made and notify the Architect/Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with Work until unsatisfactory conditions have been corrected.
- B. Provide all materials, labor and equipment for an electrical grounding system in accordance with applicable portions of the NEC and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.
- C. Accomplish grounding and bonding of electrical installations and specific requirements for systems, circuits and equipment required to be grounded for both temporary and permanent construction.

3.2 APPLICATION

- A. In branch circuit and feeder raceways, use insulated equipment grounding conductors.
- B. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated on the Drawings.
1. Use insulated spacers and mounting brackets, and support from wall 8 feet above finished floor, unless otherwise indicated.
 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

- C. Underground Grounding Conductors: Bury at least 24 inches below grade, or 6 inches below the official frost line, whichever is greater, or when crossing a duct bank, bury 12 inches above duct bank.

3.3 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and branch circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Flexible raceway runs.
 - 5. Armored and metal-clad cable runs.
 - 6. Feeders and branch circuits installed in non-metallic raceways.
- D. Separately Derived Systems: Bond the derived neutral (grounded) conductor of all separately derived system (e.g., transformers, generators, UPS) to the nearest available grounding electrode, or back to the service grounding electrode if no approved electrodes are readily available. Size the grounding electrode conductor and bonding jumpers as indicated on the Drawings or as required by NFPA 70, whichever is larger.
- E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a ground bar. Size: 1/4-by-2-by-12-inch.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Luminaires: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- H. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in PVC conduit.

3.4 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
 - 3. Verify that final backfill and compaction has been completed before driving rod electrodes.

- B. Grounding Conductors: Where the size of the grounding conductors are not shown, size in accordance with NFPA 70 Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.5 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible. Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by the manufacturers for indicated applications. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended by the manufacturers for types of service indicated.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Replace welds that are puffed up or that show convex surfaces indicating improper cleaning. Use exothermic welded connections for the following:
 - 1. All buried connections.
 - 2. Connecting conductors together.
 - 3. Connecting conductors to ground rods, except at test wells.
 - 4. Connecting conductors to building steel.
 - 5. Connecting conductors to plates.
- C. Compression Fittings: Permanent compression-type fittings may be used for the following rather than exothermic connections:
 - 1. Connecting conductors together.
 - 2. Connecting conductors to building steel.
- D. Compression fittings are not permitted under ground.
- E. Mechanical Pressure Fittings: Use bolted mechanical (removable) pressure-type clamps for the following:
 - 1. Connecting conductors to ground rods at test wells.
 - 2. Connecting conductors to pipes.
- F. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- G. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or

terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- H. Tighten screws and bolts for grounding and bonding 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.
- I. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- J. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.6 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - 4. Test Values:
 - a. The resistance between the main grounding electrode and earth ground shall be no greater than 5 ohms.
 - 5. Perform point-to-point megohmmeter tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
 - 6. Minimum system neutral-to-ground insulation resistance: one megohm.
 - 7. Investigate point-to-point resistance values that exceed 0.5 ohms.
 - a. Check for loose connections.
 - b. Check for absent or broken connections.
 - c. Check for poor quality welds.
 - d. Consider other reasons.
 - 8. Excessive Grounding Electrode Resistance: If measured resistance to earth ground value exceeds specified values, add grounding electrodes and additional conductors as required to obtain the specified value.

3.7 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of

dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 31 and 32. Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. This Section includes:
 - 1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- B. Division 26 Section "Common Work Results for Electrical" for limited scope general construction materials and methods.
- C. Division 26 Section "Equipment Wiring Systems" for electrical connections to equipment specified under other Sections, Divisions, or furnished by the Owner.
- D. Division 26 Section "Grounding and Bonding".
- E. Division 26 Section "Hangers and Supports for Electrical Systems".
- F. Division 26 Section "Underground Ducts and Raceways for Electrical Systems".
- G. Division 26 Section "Identification for Electrical Systems".
- H. Division 26 Section "Wiring Devices" for devices installed in boxes, power poles, and multi-outlet assemblies.
- I. Division 27 Section "Common Work Results for Communications".

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Division 26 Section "General Electrical Requirements".
- B. Record Drawings: Submit Record Drawings as required by Division 26 Section "General Electrical Requirements":
 - 1. Accurately record actual routing of all exterior buried raceway and all interior raceways three inches and larger. Indicate dimensions from fixed structural elements.

1.4 DEFINITIONS

- A. Terminology used in this specification is as defined below:
 - 1. EMT: Electrical Metallic Tubing
 - 2. FMC: Flexible Metal Conduit
 - 3. GRS: Galvanized Rigid Steel Conduit
 - 4. IMC: Intermediate Metal Conduit
 - 5. LFMC: Liquidtight Flexible Metal Conduit
 - 6. LFNC: Liquidtight Flexible Nonmetallic Conduit
 - 7. RAC: Rigid Aluminum Conduit
 - 8. RMC: Rigid Metal Conduit
 - 9. RNC: Rigid Nonmetallic Conduit

1.5 QUALITY ASSURANCE

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to AHJ.
 - 2. Marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.2 CONDUITS, SURFACE MOUNTED RACEWAYS AND ACCESSORIES

- A. Metal Conduit And Tubing
 - 1. Manufacturers:
 - a. AFC Cable Systems, Inc.
 - b. Alflex Corporation, a Southwire Company
 - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - d. Electri-Flex Co.
 - e. Indalex
 - f. Manhattan/CDT/Cole-Flex
 - g. O-Z/Gedney; Unit of General Signal (Fittings)
 - h. Republic Raceway
 - i. Tyco International; Allied Tube & Conduit Div.
 - j. Western Tube and Conduit Corporation
 - k. Wheatland Tube Co.
 - 2. RMC:
 - a. GRS: Hot-dip galvanized: ANSI C80.1, UL 6.
 - b. RAC: ANSI C80.5, UL6A.
 - 3. Plastic-Coated GRS and Fittings: NEMA RN 1, UL-listed. Coating thickness of 0.04 inches (1mm), minimum.
 - 4. Plastic-Coated IMC and Fittings: NEMA RN 1, UL-listed.
 - 5. EMT and Fittings: ANSI C80.3, UL 797.
 - a. Fittings: Compression type.
 - 6. FMC: Aluminum or Zinc-coated steel: UL 1.
 - 7. LFMC: Flexible steel raceway with PVC jacket: UL 360.
 - a. Fittings: NEMA FB 1; compatible with raceway and tubing materials.
- B. Nonmetallic Raceway

1. Manufacturers:
 - a. AFC Cable Systems, Inc.
 - b. American International.
 - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - d. Arnco Corp.
 - e. Cantex Inc.
 - f. Certainteed Corp.; Pipe & Plastics Group.
 - g. Condux International.
 - h. ElecSYS, Inc.
 - i. Electri-Flex Co.
 - j. Lamson & Sessions; Carlon Electrical Products.
 - k. Manhattan/CDT/Cole-Flex.
 - l. Prime Conduit (formerly Carlon)
 - m. RACO; Division of Hubbell, Inc.
 - n. Spiralduct, Inc./AFC Cable Systems, Inc.
 - o. Superflex Ltd.
 - p. Thomas & Betts Corporation.
2. RNC: Schedule 40 and 80 PVC: NEMA TC 2, UL 651.
 - a. Fittings: match to raceway type and material: NEMA TC 3, NEMA TC 6, UL 651, as applicable.

C. Metal Wireways

1. Manufacturers:
 - a. Cooper B-Line
 - b. EPI-Electrical Enclosures
 - c. Hoffman.
 - d. Square D.
2. Material and Construction: 14 gauge (minimum) sheet steel, sized and shaped as indicated, NEMA rating as required by location.
3. Fittings and Accessories: Include 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70. Where indicated, provide a barrier to divide wireway into compartments.
4. Wireway Covers: Screw-cover type.
5. Finish: Manufacturer's standard phosphate pre-treatment and baked enamel finish.

2.3 BOXES, ENCLOSURES AND CABINETS

A. General

1. Manufacturers:
 - a. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - b. Emerson/General Signal; Appleton Electric Company.
 - c. Erickson Electrical Equipment Co.
 - d. Hoffman.
 - e. Hubbell, Inc.
 - f. Killark Electric Manufacturing Co.
 - g. O-Z/Gedney; Unit of General Signal.
 - h. RACO; Division of Hubbell, Inc.
 - i. Robroy Industries, Inc.; Enclosure Division.
 - j. Scott Fetzer Co.; Adalet-PLM Division.
 - k. Spring City Electrical Manufacturing Co.

- I. Thomas & Betts Corporation.
 - m. Walker Systems, Inc.; Wiremold Company (The).
 - n. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary
- B. Outlet Boxes
- 1. Sheet Metal Outlet and Device Boxes: NEMA OS 1; UL514A.
 - 2. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
 - 3. Nonmetallic Outlet and Device Boxes: NEMA OS 2
 - 4. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified in the following paragraphs. Manufacturers and model numbers listed are used only to represent the characteristics required and are not intended to restrict the use of other Manufacturers listed above and models that meet the specified criteria.
 - a. Boxes for exposed work: deep drawn type with raised covers:
 - 1) Appleton 4S 1/2-DR; 8300 series cover.
 - 2) RACO 190 series; 800 series cover.
 - 3) Steel City 52150 series; RS series cover.
 - b. Concealed and exposed boxes for lighting:
 - 1) Appleton 40-3/4.
 - 2) RACO 160 series.
 - 3) Steel City 54170 series.
 - c. Boxes imbedded in concrete for lighting:
 - 1) Appleton OCR
 - 2) RACO 270 or 280 series.
 - 3) Steel City 54500 series.
 - d. Boxes for flush switches, receptacles, or other general devices:
 - 1) Appleton 4SVB series; 8400 series cover.
 - 2) RACO 198 series; 770 series cover.
 - 3) Steel City CWV series; 52-C-00 series cover.
 - e. Boxes for flush switches, receptacles, or other general devices installed in masonry construction:
 - 1) Appleton MI-250 series or MI-350 series.
 - 2) RACO 690 series or 960 series.
 - 3) Steel City GW series.
 - f. Boxes for telephone, data, telecommunications and audio-video outlets, refer to Division 27 Section "Common Work Results for Communications".
 - g. Exposed weatherproof boxes for general devices: cast aluminum with mounting lugs and neoprene gasket:
 - 1) Appleton FDB series.
 - 2) RACO 5300 series.
 - 3) Steel City T100L or LT100L series.
 - h. Exposed weatherproof boxes for general devices: cast aluminum with neoprene gasket:
 - 1) Appleton FS series.
 - 2) RACO 5300 series.
 - 3) Steel City T100 or LT100 series.
- C. Junction and Pull Boxes

1. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 2. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast iron with gasketed cover.
- D. Cabinets and Enclosures
1. General:
 - a. Compliance: NEMA 250; UL 50 and 508A, as applicable.
 - b. NEMA Type 1: Code-gauge phosphatized steel with continuously welded seams; manufacturer's standard ANSI 61 gray polyester powder finish inside and out; non-gasketed removable hinged front cover, with flush keyed latch and concealed hinge; collar studs.
 - c. NEMA Type 3R: Code-gauge galvanized steel with drip shield top, seam-free front, side, and back; manufacturer's standard ANSI 61 gray polyester powder finish inside and out; non-gasketed continuous-hinged door, with stainless steel pin; captive, plated steel cover screws; hasp and staple for padlocking; collar studs.
 - d. Removable painted steel interior panel mounted on standoffs; metal barriers to separate wiring of different systems and voltages.
 - e. Where keyed locks are indicated, provide 2 keys for each enclosure, with all locks keyed alike.
 - f. Provide enclosures wider than 36 inches with double doors; removable center posts; internal bracing, supports, or both, as required to maintain their structural integrity; and, accessory feet where required for freestanding equipment.
 - g. Provide clamps, grids, slotted wireways, or similar devices to which or by which wiring may be secured. Provide DIN-rail mounted terminal strips for terminating all incoming and outgoing control wiring, and power terminal blocks for incoming/outgoing power wiring.
 - h. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power and higher-voltage control wiring.

2.4 FACTORY FINISHES

- A. Finish: For metal wireway and surface raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled metal wireway and surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAYS

- A. General
1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on drawings or in this article are stricter.
 2. Provide sizes and types of raceways as indicated on the Drawings. Sizes are based on THWN insulated copper conductors, except where noted otherwise. Where sizes are not shown on the Drawings or in the Specifications, size raceways in accordance with NFPA 70 requirements for the number, size and type of conductors installed. Minimum raceway size: 1/2 (control wiring), 3/4 inch (concealed and exposed); 1 inch (underground and under slab).
 3. Provide all raceways, fittings, supports, and miscellaneous hardware required for a complete electrical system as described by the Drawings and Specifications.
 4. Install a green-insulated, equipment-grounding conductor, which is bonded to the electrical system ground, in all raceways, with the exception of Service Entrance raceways.
 5. Install grounding bushings on all conduit terminations and bond to the enclosure, equipment grounding conductor, and electrical system ground.

6. Install raceways concealed in walls or above suspended ceilings in finished areas. When approved by the Architect, raceways may be installed concealed in elevated floor slabs. Do not install raceways horizontally within slabs on grade.
7. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
8. 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.
9. Make bends and offsets so inside diameters are not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
10. Install raceways:
 - a. To meet the requirements of the structure and the requirements of all other Work on the Project.
 - b. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.
 - c. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.
 - d. Parallel or perpendicular to building lines or column lines.
 - e. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
11. Raceways shall not be permitted to be embedded in slabs.
12. Where masonry walls are left unfinished, coordinate raceway installations with other trades so that the raceways and boxes are concealed and the wall will have a neat and smooth appearance.
13. Support raceways from structural elements of the building as required by NFPA 70, Division 26 Section "Hangers and Supports for Electrical Systems". Do not support raceways by hangers used for any other systems foreign to the electrical systems; and, do not attach to other foreign systems. Do not lay raceways on top of the ceiling system.
14. Provide support spacing in accordance with NFPA 70 requirements, and at a minimum in accordance with NEMA standards. Support by the following methods:
 - a. Attach single raceway directly to structural steel with beam clamps.
 - b. Attach single raceway directly to concrete with one-hole clamps or clips and anchors. Outdoors and wherever subject to dampness or moisture, offset raceways from the surface by using galvanized clamps and clamp backs, to mitigate moisture entrapment between raceways and surfaces.
 - c. Attach groups of raceway to structural steel with slotted support system attached with beam clamps. Attach raceway to slotted channel with approved raceway clamps.
 - d. Attach groups of raceway to concrete with cast-in-place steel slotted channel fabricated specifically for concrete embedment. Attach raceway to steel slotted channel with approved raceway clamps.
 - e. Hang plumb horizontally suspended single raceway using a threaded rod. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to threaded rod with approved raceway clamps.
 - f. Hang horizontally suspended groups of raceway using steel slotted support system suspended from threaded rods. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to steel slotted channel with approved raceway clamps.
 - g. Support conductors in vertical raceway in accordance with NFPA 70 requirements.
 - h. Cross-brace suspended raceway to prevent lateral movement during seismic activity.
 - i. Use pre-fabricated non-metallic spacers for parallel runs of underground or under-slab conduits, either direct buried or encased in concrete.

15. Install electrically- and physically-continuous raceways between connections to outlets, boxes, panelboards, cabinets, and other electrical equipment with a minimum possible number of bends and not more than the equivalent of four 90-degree bends between boxes. Make bends smooth and even, without flattening raceway or flaking the finish.
16. Protect all electrical Work against damage during construction. Repair all Work damaged or moved out of line after rough-in, to meet the Architect's approval, without additional cost to the Owner. Cover or temporarily plug openings in boxes or raceways to keep raceways clean during construction. Clean all raceways prior to pulling conductors or cables.
17. Align and install raceway terminations true and plumb.
18. Complete raceway installation before starting conductor installation.
19. Install a pull cord in each empty raceway that is left empty for installation of wires or cables by other trades or under separate contracts. 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 cord.
20. Install approved expansion/deflection fittings where raceways pass through or over building expansion joints.
21. Route raceway through roof openings for piping and ductwork or through roof seals approved by the Architect, the roofing contractor, or both. Obtain approval for all roof penetrations and seal types from the Architect, Owner, roofing contractor, or all three as required to maintain new or existing roofing warranties.
22. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from building exterior to building interior.
 - b. Where otherwise required by NFPA 70.
23. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with GRS; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

B. RMC

1. Use GRS in the following areas:
 - a. Where indicated.
 - b. Exterior applications where above grade and exposed.
 - c. Below grade when concrete-encased, plastic-coated, or provided with a corrosion resistant approved mastic coating.
 - d. All 90-degree elbows below grade, 3 inches or larger, use plastic-coated raceway or provide with a corrosion resistant approved mastic coating.
 - e. First 5 feet of horizontal run out from the building to allow for building settling over time.
 - f. Exposed, where subject to physical abuse, such as hallways, mechanical rooms, storage rooms and janitor closets:
 - 1) GRS: vertical risers below 7 feet AFF
2. Do not use IMC:
 - a. In any location.
3. Use RAC in the following areas:
 - a. Indoors above grade.
 - b. Interior wet or damp locations.

- c. For circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
 - 4. Do not use RAC:
 - a. Below grade.
 - b. Imbedded in concrete or other areas corrosive to RAC.
- C. EMT
 - 1. Use EMT in the following areas:
 - a. Where indicated.
 - b. Interior concealed locations for:
 - 1) Branch and feeder circuits.
 - 2) Low-voltage control, security, and fire alarm circuits
 - 2. Do not use EMT:
 - a. Below grade.
 - b. In exterior applications when exposed.
 - c. Exposed, where subject to physical abuse, such as hallways, mechanical rooms, storage rooms and janitor closets, and below 7 feet AFF.
- D. FMC and LFMC
 - 1. Use FMC or LFMC:
 - a. For the final 24 inches of raceway to all motors, transformers, and other equipment subject to vibration or movement.
 - b. From outlet boxes (attached to building structure) to recessed light fixtures. Install sufficient length to allow for relocating each light fixture within a 5-foot radius of its installed location.
 - 2. Do not use FMC or LFMC:
 - a. For branch circuits, homeruns or feeders.
 - b. In lengths exceeding 6 feet.
 - 3. Use FMC only in dry locations; use LFMC in damp, wet, corrosive, and outdoor locations.
- E. RNC
 - 1. Solvent-weld RNC fittings and raceway couplings per the manufacturer's instructions and make all connections watertight. Use solvent of the same manufacturer as the raceway.
 - 2. Where installed exposed outdoors or other areas subject to temperature variations, install expansion fittings per Article 352.44 of NFPA 70, to accommodate thermal expansion in straight runs.
 - 3. Use RNC in the following locations:
 - a. Only where specifically indicated, and then only as specified below.
 - b. Underground, single and grouped, in lieu of GRS, when indicated.
 - 1) Direct buried
 - 2) Concrete-encased (use approved rigid PVC interlocking spacers, selected to provide minimum duct spacing and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts).
 - 3) Use Schedule 80 PVC where underground conduit emerges from concrete.
 - 4. Do not use RNC:
 - a. Exposed indoors
 - b. In occupied spaces.

- c. In return air plenums.
 - d. Where subject to physical damage.
 - e. Where not permitted by codes.
- F. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. RMC: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings and installation tools approved by the manufacturer for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits. Replace all fittings and conduits that have any portion of the coating scraped off to bare metal, at no additional cost to the Owner.
 3. Join raceways with fittings designed and approved for that purpose and make joints tight.
 4. Use insulating bushings to protect conductors at raceway terminations:
 - a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - b. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- G. Telephone and Signal/Data System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- H. Wireways
1. Use flat head screws, clips and straps to fasten wireways to surfaces. Mount plumb and level.
 2. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
 3. Close ends of wireway and unused raceway openings.
- I. Surface Raceways
1. Use flat head screws, clips and straps to fasten surface raceways to surfaces. Mount plumb and level.
 2. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
 3. Close ends of surface raceway.

3.2 BOXES

- A. General
1. Verify locations of device boxes prior to rough in.
 2. Set boxes at elevations to accommodate mounting heights as specified or indicated on the Drawings.
 3. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box locations to accommodate intended purpose.
 4. Install boxes to preserve fire ratings of walls, floors, and ceilings.
 5. Install flush wall-mounted boxes without damaging wall insulation or reducing its effectiveness.
 6. Support boxes independently of raceway.
 7. Clean the interior of boxes to remove dust, debris, and other material. Clean exposed surfaces and restore finish.
 8. Adjust flush-mounted boxes to make front edges flush with finished wall material.
 9. Provide boxes of the depth required for the service, device and the application, and with raised covers set flush with the finished wall surface for boxes concealed in plaster finishes.

Select covers with the proper openings for the devices being installed in the boxes. Install boxes flush unless otherwise indicated.

10. Install outlet boxes in firewalls complying with UL requirements, with box surface area not exceeding 16 square inches; and, when installed on opposite sides of the wall, separate by a distance of at least 24 inches.

B. Outlet Boxes

1. Install all electrical devices, such as plug receptacles, lamp receptacles, light switches, and light fixtures in or on outlet boxes.
2. Locations of outlets on Drawings are approximate; and, except where dimensions are shown, determine exact dimensions for locations of outlets from plans, details, sections, or elevations on Drawings, or as directed by Architect. Locate outlets generally from column centers and finish wall lines or to centers or joints of wall or ceiling panels.
3. Locate outlet boxes so they are not placed back-to-back in the same wall, and in metal stud walls, so they are separated by at least one stud space, to limit sound transmission from room to room. Install outlet boxes in accessible locations and do not install outlets above ducts or behind furring.
4. Install extension and plaster rings as required by NFPA 70.
5. Carefully set outlet boxes concealed in non-plastered block walls so as to line up with wall joints. Coordinate the box and raceway installation with the wall construction as required for a flush and neat appearing installation. Outlet box extensions may be used where necessary.
6. Do not exceed allowable fill per NFPA 70.
7. Where multiple devices are shown grouped together, gang mount with a common cover plate.

C. Junction and Pull Boxes

1. Install junction and pull boxes above accessible ceilings and in unfinished areas.
2. Provide boxes set flush in painted walls or ceilings with primer coated cover.
3. Where junction and pull boxes are installed above an inaccessible ceiling, locate so as to be easily accessible from a ceiling access panel.
4. Boxes for exterior use shall be:
 - a. PVC with a UV-stabilized PVC cover sealed and gasketed watertight.
 - b. Cast aluminum with a cast aluminum cover sealed and gasketed watertight.
 - c. Cast iron with cast iron cover sealed and gasketed watertight in vehicular traffic areas. Provide box and cover UL listed for use in vehicular traffic areas.
 - d. Install buried boxes so that box covers are flush with grade, unless indicated otherwise.

3.3 CABINETS AND ENCLOSURES

- A. Unless otherwise indicated on the Drawings, provide NEMA 1 construction for indoor, dry locations; NEMA 12 for indoor, damp and dusty locations; NEMA 3R for outdoor locations..
- B. Install flush mounted in the wall in finished spaces, with the top 78 inches above finished floor. The front shall be approximately 3/4-inch larger than the box all around.
- C. Install surface mounted in unfinished spaces, with the top 78 inches above finished floor. The front shall be the same height and width as the box.
- D. Electrically ground all metallic cabinets and enclosures. Where wiring to cabinet or enclosure includes a grounding conductor, provide a grounding lug in the interior of the cabinet or enclosure. Cabinets and enclosures specified in this Section are intended to house miscellaneous electrical components assembled in a custom arrangement, such as contactors and relays.
- E. All components that are specified or indicated for assembly in cabinets and enclosures shall each be individually UL listed and labeled. Arrange wiring so that it can be readily identified. Support

wiring no less than every 3 inches. Install gauges, meters, pilot lights and controls on the face of the door.

- F. Do not provide cabinets and enclosures smaller than the sizes indicated. Where sizes and types are not indicated, provide cabinets and enclosures of the size, type and classes appropriate for the use and location per the guidelines of the NEC. Provide all items complete with covers and accessories required for the intended use.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Nameplates
 - 2. Labels for raceways and metal-clad cable.
 - 3. Labels for junction boxes and pull boxes.
 - 4. Labels for wiring devices and lighting control devices.
 - 5. Markers for conductors, and control cables.
 - 6. Tags.
 - 7. Underground-line warning tape.
 - 8. Warning labels and signs.
 - 9. Arc Flash Warning Labels.
 - 10. Instruction signs.
 - 11. Miscellaneous identification products.
 - 12. Painted Identification.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Where a facility identification standard already exists, that standard shall be continued. Where an identification standard does not exist, color-coding and identification shall be as described herein.
- B. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- C. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- D. Coordinate installation of identifying devices with location of access panels and doors.
- E. Install identifying devices before installing acoustical ceilings and similar concealment.

1.3 SUBMITTALS

- A. Product Data: Submit the following in accordance with Division 26 Section "General Electrical Requirements" for each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7 and that are acceptable to authorities having jurisdiction.
 - 2. Marked for intended use.
- B. Comply with ANSI A13.1 and ANSI C2.
- C. Comply with NFPA 70.
- D. Comply with 29 CFR 1910.145.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

- A. Location, text, and method of identification to be used is noted in individual sections. Refer to related sections for additional identification requirements.

2.2 NAMEPLATES

- A. Engraved, Laminated Acrylic or Melamine Label, adhesive backed. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high. For elevated components, increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 1. Normal systems - black letters on a white background.
 - 2. Emergency systems - white letters on a red background

2.3 LABELS FOR RACEWAYS AND METAL-CLAD CABLE

- A. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.4 LABELS FOR JUNCTION BOXES AND PULL BOXES

- A. Junction box and pull box covers shall be spray painted to identify the voltage and system. Circuit numbers and the panel they originate from shall be listed on the cover using permanent, waterproof, black ink marker.

2.5 LABELS FOR WIRING DEVICES AND LIGHTING CONTROL DEVICES

- A. Self-laminating Computer Printable Labels: Clear over-laminate to protect legend for permanent, clean identification. Self-laminating Polyester material with white print-on area.
- B. Engraved, Laminated Acrylic or Melamine Label: adhesive backed. Minimum letter height shall be 3/16 inch (4.76 mm).
 - 1. Normal systems - black letters on a white background.
 - 2. Emergency systems - white letters on a red background
- C. Engraved cover plates: Provide with white letters. White or ivory cover plates shall have black letters.

2.6 MARKERS FOR CONDUCTOR AND CONTROL CABLES

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

- B. Self-laminating Computer Printable Labels: Clear over-laminate to protect legend for permanent, clean identification. Self-laminating Polyester material with white print-on area.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

2.7 TAGS

- A. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.8 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Printed legend shall indicate type of underground line.

2.9 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied and shall not compromise any NRTL listing or labeling criteria.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. 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 (208 Volts): "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 - 3. Workspace Clearance Warning (480 Volts): "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 48 INCHES (915 MM)."

2.10 ARC FLASH WARNING LABELS

- A. 3.5 in. x 5 in., unless otherwise noted by Owner, thermal transfer type label of high adhesion polyester for each work location analyzed.

- B. All labels will be based on recommended overcurrent device settings and will be printed after the results of the analysis have been presented and after any system changes, upgrades, or modifications have been incorporated in the system.
- C. The label shall include the following information, at a minimum:
 - 1. Location designation
 - 2. Source protective device name providing the protection (fed from)
 - 3. Nominal voltage
 - 4. Available fault current
 - 5. Flash protection boundary
 - 6. Hazard risk category
 - 7. Incident energy
 - 8. Working distance
 - 9. Engineering report number, revision number and issue date.
- D. Labels shall be machine printed, with no field markings.
- E. Labels shall comply with University of Missouri Consultant Procedures & Design Guidelines.

2.11 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes. Unless indicated otherwise, provide with minimum 3/8-inch- (10-mm-) high letters.
 - 1. Punched or drilled for mechanical fasteners.
 - 2. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
 - 3. Normal systems: Engraved legend with white letters on black face.
 - 4. Essential Systems: Engraved legend with white letters on red face.

2.12 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Nameplates, Labels and Signs
 - 1. Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat lock washers unless otherwise noted.

2.13 PAINTED IDENTIFICATION

- A. Paint materials and application requirements are specified in Division 09 painting Sections.
 - 1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
 - a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior concrete and masonry primer.
 - 2) Finish Coats: Exterior semi-gloss acrylic enamel.
 - 2. Exterior Concrete Unit Masonry:
 - a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Exterior semi-gloss acrylic enamel.

3. Exterior Ferrous Metal:
 - a. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semi-gloss alkyd enamel.
4. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semi-gloss alkyd enamel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify identity of each item before installing identification products.
- B. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- C. Painted Identification: Prepare surface and apply paint according to Division 09 painting sections.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. For surfaces that require finish work, apply identification devices after completing finish work.
- C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- D. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- E. Equipment Nameplates and Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual

END OF SECTION

SECTION 26 05 73 - LOW-VOLTAGE ELECTRICAL SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies, and the setting of these devices.
 - 1. Also include coordination of series-rated devices where series rating is specified in other sections and where indicated on Drawings.
 - 2. The AIC ratings indicated on the Drawings are preliminary and will be finalized based on the results of the fault current study. Device ratings for furnished equipment shall be as required by the results of the fault current study at no additional cost.
- B. Study must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If study has not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project.

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this section.

1.3 SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.
- C. Qualification Data: For coordination-study specialist.
- D. Other Action Submittals:
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Coordination-study report.
 - 3. Equipment evaluation report.
 - 4. Arc-Flash Hazard Analysis.
 - 5. Setting report.
- E. Record Drawings: Submit Record Drawings as required by Division 26 Section "General Electrical Requirements":
 - 1. Accurately record on the One-Line Diagram actual ratings and settings for all overcurrent devices, both adjustable and non-adjustable, including all changes made during construction, due to the study, or both.
- F. Electronic files, SKM project files using backup command, of the time-current characteristic curves for every different overcurrent device used in the reports.

1.4 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

- B. Coordination-Study Specialist Qualifications: An organization experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 399 for general study procedures.
- D. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- E. Comply with IEEE 1584 and NFPA 70E for arc-flash hazard calculations.

PART 2 - PRODUCTS AND MATERIALS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide computer software programs developed by one of the following:
 - 1. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399, Table 7-4.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices.
 - 1. Zero-Sequence current.
 - 2. Arcing faults.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
- B. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices not submitted for approval with coordination study may not be used in study.
- C. Fault current study and coordination study to be performed prior to the final submittals for any piece of electrical equipment which has an AIC rating or an over-current protective device so that correct equipment gets ordered for the project conditions.
- D. Arc Flash Study must be performed after conductors and equipment have been installed and after the project's utility company confirms the available fault current. A final coordination study with all device settings shall be submitted with the Arc Flash Study. The goal of the revised settings is to minimize the arc flash hazard while maintaining reasonable coordination and selectivity. For the components of emergency and legally required standby system components, full selectivity must be maintained.

3.2 SYSTEM COMPONENTS TO BE INCLUDED IN STUDIES

- A. Study shall begin with the utility and each alternate power source overcurrent device(s) serving the Project and end at the last branch circuit overcurrent protective device. This includes studies of the complete paths on both sides of any transfer switch, contactor or circuit breaker.
- B. Components include, but are not limited to:
 - 1. Distribution Panelboards
 - 2. Panelboards

3.3 POWER SYSTEM DATA FOR STUDIES

- A. Gather and tabulate the following input data to support studies:
 - 1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical distribution system diagram showing the following:
 - a. Load current that is the basis for sizing continuous ratings of circuits for cables and equipment.
 - b. Circuit-breaker and fuse-current ratings and types.
 - c. Relays and associated power and current transformer ratings and ratios.
 - d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - e. Generator kilovolt amperes, size, voltage, and source impedance.
 - f. Cables. Indicate conduit material, sizes of conductors, conductor insulation, and length.
 - g. Busway ampacity and impedance.
 - h. Motor horsepower and code letter designation according to NEMA MG 1.
 - 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Magnetic inrush current overload capabilities of transformers.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's overcurrent protective devices.
 - e. Special overcurrent protective device settings or types stipulated by utility company.
 - f. Time-current-characteristic curves of devices indicated to be coordinated.
 - g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - i. Panelboards, switchboards, motor-control center ampacity, and interrupting ratings in amperes rms symmetrical.

3.4 FAULT-CURRENT STUDY

- A. Source Impedance: University utility power distribution fault-current contribution as indicated.

- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project and use approved computer software program to calculate values. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.
- E. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with the following:
 - 1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.50.
 - 2. Low-Voltage Fuses: IEEE C37.46.
 - 3. Circuit Breakers: IEEE C37.13.
- F. Study Report:
 - 1. Enter calculated X/R ratios and interrupting (5-cycle) fault currents on electrical distribution system diagram of the report.
 - 2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.
 - 3. List other output values from computer analysis, including momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault-current values for 3-phase, 2-phase, and phase-to-ground faults.
- G. Equipment Evaluation Report: Prepare a report on the adequacy of overcurrent protective devices and conductors by comparing fault-current ratings of these devices with calculated fault-current momentary and interrupting duties.

3.5 COORDINATION STUDY

- A. Perform coordination study and prepare a written report using the results of fault-current study and approved computer software program. Comply with IEEE 399.
- B. Comply with NFPA 70 for overcurrent protection of circuit elements and devices.
- C. Comply with IEEE 241 recommendations for fault currents and time intervals.
- D. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device shall protect transformer according to IEEE C57.12.00, for fault currents.
- E. Motors served by voltages more than 600 V shall be protected according to IEEE 620.
- F. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents.
- G. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.

- b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve the level of selective coordination required in the contract documents or by the edition of the National Electrical Code (including any local jurisdiction amendments) the project must comply with. Graphically illustrate that adequate time separation exists between series devices, including power utility company's upstream devices. Show the following specific information:
- a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
3. Completed data sheets for setting of overcurrent protective devices.
4. For emergency, legally required standby and health care essential power systems, such systems must selectively coordinate to the values indicated below unless local amendments to the National Electrical Code require a different value.
- a. Emergency (NEC article 700) 0.01 seconds
 - b. Elevator Systems (NEC article 620) 0.01 seconds

3.6 OVERCURRENT PROTECTIVE DEVICE SETTING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative, of electrical distribution equipment being set and adjusted, to assist in setting of overcurrent protective devices within equipment.
1. After installing overcurrent protective devices and during energizing process of electrical distribution system, perform the following:
 - a. Verify that overcurrent protective devices meet parameters used in studies.
 - b. Adjust devices to values listed in study results.
 - c. Adjust devices according to recommendations in Chapter 7, "Inspection and Test Procedures," and Tables 100.7 and 100.8 in NETA ATS.

3.7 ARC-FLASH HAZARD ANALYSIS

- A. Determine arc-flash incident energy levels and flash protection boundary distances based on the results of the Short-Circuit and Coordination studies. Perform the analysis under worst-case arc-flash conditions for all modes of operation.
- B. Identify all locations and equipment to be included in the arc-flash hazard analysis:
1. Include a copy of the facility one-line in the report.
 2. Include Utility data for high and low short circuit values.
 3. Identify the possible system operating modes including tie-breaker positions, and parallel generation.
 4. Calculate the arcing fault current flowing through each branch for each fault location.
 5. Determine the time required to clear the arcing fault current using the protective device settings and associated trip curves.
 6. Select the working distances based on system voltage and equipment class.

7. Calculate the incident energy at each fault location at the prescribed working distance.
 8. Calculate the flash protection boundary at each fault location.
 9. Document the assessment in reports and one-line diagrams.
 10. Provide labels to be placed on each piece of equipment analyzed. At a minimum, each label shall list the following:
 - a. Location
 - b. Source protective device name providing the protection (fed from)
 - c. Nominal system voltage
 - d. Arc flash boundary
 - e. Specific arc incident energy available
 - f. Bolted fault current available
 - g. Label date
- C. Results of the arc-flash study shall be summarized in a final report containing the following:
1. Basis, method of hazard assessment, description, purpose, scope, and date of the study.
 2. Tabulations of the data used to model the system components and a corresponding one-line diagram.
 3. Descriptions of the scenarios evaluated and identification of the scenario used to evaluate equipment ratings.
 4. Tabulations of equipment incident energies, hazard risk categories, and flash protection boundaries. The tabulation shall identify and clearly note equipment that exceeds allowable incident energy ratings.
 5. Required arc-flash labeling and placement of labels.
 6. Conclusions and recommendations.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Distribution panelboards.
- B. Lighting and appliance branch-circuit panelboards.
- C. Disconnecting and Overcurrent Protective Devices.
- D. Surge Protection Devices.
- E. Accessory Components and Features.

1.2 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. SPD: Surge Protection Device

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
- C. Fault-Current Study, Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section "Overcurrent Protective Device Coordination Study"
- D. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: Submit final panelboard directories.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
 1. Routine maintenance requirements for panelboards and all installed components.
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 3. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 FIELD CONDITIONS

- A. Environmental Limitations:
 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).

1.8 WARRANTY

- A. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Enclosures: Flush- or surface-mounted cabinets as noted.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Hinged Front Cover: Entire front trim hinged to box.
 - 3. Door: Standard door with concealed hinges, within hinged trim cover. Secured with vault-type latch with tumbler lock; keyed alike.
 - 4. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - 5. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and/or bottom as required.
- D. Buses: Three phase, four wire unless otherwise indicated.
 - 1. Phase, and Neutral Buses:
 - a. Material:
 - 1) Hard-drawn copper, 98 percent conductivity.
 - b. Size: Ampacity as indicated on drawings, with uniform capacity for entire length of panelboard's sections.
 - 1) Neutral bus: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus
 - 2. Ground Bus: Equipped with connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - a. Material: Hard-drawn copper, 98 percent conductivity
 - b. Size: Minimum-size required by UL 67
 - 3. Split Bus: Vertical buses divided horizontally into individual vertical sections.
- E. Line-Side Conductor Connectors (Lugs):
 - 1. General: Suitable for use with conductor material and sizes. Connections shall comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
 - 2. Material: Same as bus material.

3. Capacity rating: Same as associated bus.
 4. Type: Provide compression type unless otherwise indicated on Drawings, refer to schedules and one-line diagram.
- F. Subfeed lugs (Double Lugs):
1. General: Suitable for use with conductor material and sizes. Connections shall comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
 2. Location: Locate at same end of bus as incoming lugs or main device.
 3. Material: Same as line side conductor connectors.
 4. Capacity rating: Same as associated bus.
 5. Type: Same as line side conductor connectors.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating – Fully Rated: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. See manufacturers above.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: As indicated on drawings.
- E. Branch Overcurrent Protective Devices:
1. Connection to bus:
 - a. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 - b. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers
 2. Type: Provide types as indicated on drawings and as defined below.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. See manufacturers above.
- B. Panelboards: Circuit breaker type: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: As indicated on drawings.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. See manufacturers above.
- B. Arc Flash Mitigation
1. Overcurrent devices, 1200 A and larger, shall be provided with an energy-reducing active arc flash mitigation capability. The energy-reducing active arc flash mitigation system shall allow the operator to enable a maintenance mode using a switch which enables a preset accelerated instantaneous override trip to reduce arc flash energy. An LED on the trip unit shall indicate the trip unit is in the maintenance mode.

- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical type unless otherwise indicated on Drawings, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 1) Mounting: Integral
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- E. Fuses are specified in Division 26 Section "Fuses."

2.5 SURGE PROTECTION DEVICES

- A. Provide surge protective devices as required by Division 26 Section "Surge Protective Devices".
- B. Panelboards requiring SPD and the location of the devices shall be as indicated on the Drawings.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Wall-Mounted Panelboards: Install panelboards on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For panelboards not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Mount top of trim 72 inches (1788 mm) above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. General: Provide identification complying with requirements specified in Division 26 Section "Identification for Electrical Systems."
- B. Panelboard Nameplates: Label each panelboard with a nameplate.
- C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate.
- D. Warning Labels: Label each panelboard with a warning label in accordance with NFPA 70 and NFPA 70E.
 - 1. Exception: Do not install NFPA 70 working clearance requirements on flush panelboards and similar equipment in finished spaces.
- E. Identify field-installed conductors, interconnecting wiring, and components; complying with Division 26 Section "Identification for Electrical Systems."
- F. Panel Directories
 - 1. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
 - 2. Noted the date the directory was created/updated.
 - 3. Create directory after loads have been balanced.

3.4 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 27 41 16 – AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Integrated Audio-Video Systems and Equipment as part of the Work.

1.2 SECTION INCLUDES

- A. Project instruction for the Contractor, and Sound System description details.
- B. Sound System Product description.
- C. Project completion instruction for the Contractor.

1.3 RESPONSIBILITY

- A. This is a renovation project. Computer based CAD drawings are very limited and available for only the main and section plans with significant level of detail variations on each and as such the documents may not depict every detail or existing condition needed to complete this work. The Contractor is responsible for reviewing all existing site conditions that may affect the installation of this work with any exclusions clearly noted within RFP response. If a specific task implied or described within the drawings and specifications is not listed as excluded, it is assumed to be included and to be provided as part of this work.
- B. As a renovation project, existing conditions both physical and related to electronic systems, are present. Reasonable effort to identify conditions prior to bid is expected. Notify Owner immediately of any items or issues discovered during construction which prevent or obstruct progress or completion of scope. Provide a solution or remedy to the issue with a rough order of magnitude cost for workable solution.
- C. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply all materials, equipment, transportation, engineering, and labor necessary to provide a fully working, tested, and calibrated system. Supply accessories and equipment (such as, but not limited to: power strips, adapters, connectors, mounting hardware, etc.) needed for a complete system, even if not specifically mentioned in these Specifications. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.
- D. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Owner for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Owner.

- E. Execute all work in accordance with the National Electrical Code (NEC), the National Electrical Safety Code, the Occupational Safety and Health Act (OSHA) and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform Work.
- F. Required licenses, insurance, and permits including payment of charges and fees.
- G. Verification of dimensions and conditions at the job site.
- H. Coordinate location and installation of equipment, power, grounding, and raceways with other building elements.
- I. Preparation of submittal information.
- J. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable.
- K. Development and implementation of AV control system software code and control panel layouts, which will become the property of the Owner.
- L. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction (AHJ).
- M. Final tests and adjustments, written report, and documentation.
- N. Instruction of operating personnel.
- O. Provision of manuals.
- P. Maintenance services and warranty.

1.4 RELATED WORK

- A. Coordination between disciplines is required to achieve a proper system installation.
- B. Electrical
 1. Electrical work shall be coordinated with division 26.
 2. Provide breaker panel and distribution of electrical power from the panel to the equipment as required.
 3. A ground point will be provided in each equipment room or enclosure electrical panel. Provide connecting ground point to all equipment in accordance with NEC Code, local codes, and standards specified herein.
 4. Provide conduit infrastructure system

- a. Conduit and Cable Management
 - 1) Install cabling in conduit, provided as shown on the Electrical and AV drawings. If additional conduit/raceway/tray is required for systems, provide at no additional cost.
 - 2) Conduit/raceway/tray/wire management not shown on these drawings, but required for a complete system, or by code, is to be included in this scope of work.
 - 3) Exterior junction boxes, conduit/raceway, terminations, etc. and those within enclosures where enclosures are exposed to outdoor conditions are to meet NEMA ratings for outdoor electrical applications.

C. Structural

- 1. The contractor shall be responsible for design and structural engineering for all loudspeaker brackets attaching the loudspeakers (and/or loudspeaker hoisting system) to the building structure at position shown within the drawings. Coordinate device weight loads with the Project's Structural Engineer.

D. Networks

- 1. Provide network switches, cable plant, and interfaces as required for two discrete audio systems in the venue: Seating Bowl PA and Back-of-House PA.
- 2. Provide dedicated network cabling and hardware to support control of, and audio feed to, Priority Communications System processors and amplifiers which are part of the seating bowl public address system.
- 3. Coordinate with the data network installer and in-house IT department to establish non-conflicting IP addresses for all of the AV equipment. Ensure that the configuration of the audio distribution and control networks for both seating bowl PA and back of house systems audio are secure, and that all reasonable measures are taken to prohibit unauthorized access to the audio streams, audio routing, and control features of the Digital Audio Network (DAN).

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:

- 1. American National Safety Institute (ANSI)
- 2. American Society of Testing and Materials (ASTM)
- 3. Electronics Industries Association (EIA)
- 4. Federal Communications Commission (FCC)
- 5. National Electrical Manufacturer's Association (NEMA)
- 6. National Electrical Code (NEC)
- 7. Underwriters Laboratories (UL)
- 8. Occupational Safety and Health Administration (OSHA)
- 9. Society of Motion Picture and Television Engineers (SMPTE)
- 10. Building Industry Consulting Service International (BICSI)
- 11. Americans with Disabilities Act (ADA)
- 12. AVIXA published standards
- 13. Davis and Davis, Sound System Engineering (3rd Edition) (SSE), Howard W. Sams, 2006
- 14. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 2013
- 15. AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm (AVIH), 2009
- 16. Middle Atlantic – Thermal Management White Paper

1.6 DEFINITIONS

- A. In addition to those Definitions of Division 1, the following list of terms as used in this specification shall be defined as follows:
1. Furnish: To purchase, procure, acquire, and deliver complete with related accessories.
 2. Install: To set in place, join, attach, link, set up, or otherwise connect together and test until complete before turning over to the Owner. All parts, items, or equipment supplied by Contractor.
 3. Provide: To furnish and install.

1.7 SYSTEMS DESCRIPTIONS AND REQUIREMENTS

- A. The following is intended to provide an overview of the required work details, system features, and design concepts for the Work as shown on the project drawings and is not intended to be an exhaustive description of the systems.
- B. The Work includes updates to the scoreboard loudspeaker system.
1. Demolition:
 - a. Remove existing Meyer Soundbeams.
 - b. Remove any cabling not scheduled for re-use.
 2. Subwoofers:
 - a. Locate sixteen Type 20 loudspeakers in the scoreboard middle and upper bay.
 3. Pathways:
 - a. Provide 4" conduit from scoreboard upper bay to the new equipment rack with 32" x 32" x 8" junction box located in the scoreboard upper bay.
 4. Equipment Rack:
 - a. Provide new floor supported environmental equipment rack at base of scoreboard to house new amplifiers. Coordinate final location with Owner.
 5. Existing main loudspeakers:
 - a. Test, and provide repair as needed to loudspeaker components.
 - b. Inspect rigging. Report items of concern to the Owner.
 6. Network:
 - a. Add network switches to Equipment Rack Room, Audio Control Booth, and new environmental equipment rack.
 - b. Re-use existing multi-mode fiber to connect the Audio Control Booth equipment to the Equipment Rack Room.
 - c. Use existing pathways to connect the Equipment Rack Room network equipment to the new environmental equipment rack located at the base of the scoreboard. Provide fiber optic cable for this connection as needed.
 7. DSP:
 - a. Provide new DSP with Dante capability in the Audio Control Booth.
 - b. Provide Touch Panel (TP) for control of subwoofer system. Field coordinate Touch Panel location with Owner.
 8. Fire Alarm Interface
 - a. As an aid to the fire alarm system, the Main Seating Bowl systems will receive warning signals and announcements from the main fire command center. Coordinate final configuration with Owner and Authority Having Jurisdiction (AHJ).
 - b. Provide cabling to interface Audio System with Fire Alarm Panel
 - c. Provide contact closure(s) interface to the Audio System as needed
 - d. Provide analog audio input to the Audio System DSP
 - e. Provide GPIO contact closure points in the Audio System DSP

- f. Insert a 24dB/Octave Butterworth 300 Hertz high-pass filter in the DSP Fire Alarm signal path, to reduce Sound System electrical load on the emergency electrical systems
- C. DSP Software Revisions:
1. Incorporate new subwoofers and field coverage systems into existing DSP system.
 2. Provide manufacturer loudspeaker settings, loaded into the appropriate signal path, for new loudspeakers.

1.8 SUBMITTALS

- A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated.
- B. Submittals shall contain sufficient information to describe the Work to be performed. Reviewed shop drawings are to be used for final coordination and construction.
- C. Shop drawings must be original work produced by the Contractor responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.
- D. Supplementary submittal requirements:
1. Provide the following in one submission for approval within thirty days of issuance of Notice to Proceed (NTP) and prior to commencement of Work:
 - a. Complete schedule of submittals.
 - b. Chronological schedule of Work in bar chart form.
 - c. Product Data Sheets:
 - 1) Submissions that do not follow the format and configuration described will be returned without review.
 - 2) Provide a complete table of contents with the following information:
 - a) Project title.
 - b) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
 - c) Date of submission.
 - d) Provide a list of and Manufacturer's data sheets on products to be incorporated with the Work. Arrange data sheets in the same order they appear in this specification. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
 - e) Submit manufacturer's product literature for each type of firestop material to be used. Literature shall include documentation of UL classifications or approved third party testing. Manufacturer's name and number for each part shall be included. Submit drawings of through penetrations, which include the system to be utilized for the firestopping application. Drawing shall indicate construction of wall or floor assembly; size, number and material of penetrating items; firestop system designation; required F-rating, T-rating and remarks.

- f) Provide high quality copies with all text legible and illustrations of adequate resolution and sharpness for review. Internet web pages, faxed copies or copies with portions of the information missing or smeared not acceptable.
- d. Shop Drawings:
 - 1) Functional Diagrams/Schematics:
 - a) Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and cable designators, and device designators. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
 - 2) Coordination Drawings:
 - a) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the AV System in relationship with other building components. Prepare drawings to an accurate scale of 1/8" = 1'-0" or larger on suitable sized media.
 - b) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the work including but not necessarily limited to the following:
 - (1) Equipment housings
 - (2) Ceiling and wall mounted devices
 - (3) Raceways
 - (4) Cabling
- e. Equipment housing: Location of equipment in racks, consoles position on tables or counters. Details to include dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
- f. Patch panel layouts and labeling strips, including color schemes.
- g. Full fabrication details of custom enclosure and millwork indicating size, material, finish and openings required for equipment and enclosures.
- h. Structural rigging and mounting details:
 - 1) Loudspeaker rigging, suspension, and mounting detail drawings shall be signed and sealed by a professional engineer licensed to practice in the state in which the project is located. The signed and sealed drawings noted above to include the following:
 - a) Analysis of all components in the load path and attachment method to building structure for suspended loudspeakers.
 - b) Attachment method for mounting brackets at ceilings, walls, or other building features.
 - c) Detail the product manufacturer, part numbers, and load capacity of the hardware fittings and materials selected for suspended or mounted loudspeakers.
 - d) A copy of the design calculations.
 - e) Secondary steel required for attachment to the building structure.
 - f) Custom brackets, mounts, suspension grids or trusses, loudspeaker cabinet frames, or loudspeaker brackets.
 - g) Loudspeaker brackets or mounts provided by the specific loudspeaker manufacturer being installed that do not include traceability data.
 - 2) Traceability data and/or ANSI standard compliance data for loudspeaker mounting brackets or rigging provided by the loudspeaker manufacturer.
 - 3) Risk analysis data as referenced in Part 3.2, F

- 4) Stamping Engineer post-installation sign-off as described in Part 3.2, F
- 5) Proof of ETCP certification for on-site rigging crew.
- i. Fabricated Plates and Panels
 - 1) Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material. Provide samples of plate color options for review.
- j. Labeling
 - 1) Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
- k. Schedules
 - 1) Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.
- l. Control System Software
 - 1) Provide electronic copies of proposed control system user interfaces within sixty (60) days of issuance of Notice to Proceed (NTP).
- m. IP Addresses
 - 1) Coordinated with the venue IT Administrator, provide a list of IP addresses, by device, used in the project.

E. Submittal format:

- 1. Consultant's project documents in electronic format will not be supplied to the Contractor for their use as part of submittals.
- 2. Standards:
 - a. Floor plan drawings executed at an appropriate scale, not less than 1/8" = 1'-0".
 - b. Detail drawings executed at an appropriate scale, not less than 3/8" = 1'-0".
 - c. Plate and panel drawings executed at an appropriate scale, not less than 1/2" = 1'.
 - d. Rack, enclosure, and millwork detail drawings executed at an appropriate scale, not less than 1" = 1'-0".
- 3. Electronic Submittals: Submit in non-proprietary PDF format. Combine product literature into a single file for each Part 2 subheading (i.e.: 2.3 Microphones and Accessories, 2.4 Input Sources, etc.). Shop drawings may be combined into logical sections such as legend, floor plan, section, detail, functional, etc.
- 4. Hardcopy Submittals: Bind submittal in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.

F. Resubmission requirements:

- 1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
- 2. Indicate all changes that have been made by clouding and noting with a revision marker. Drawing title block to track all revisions.
- 3. Also indicate all changes that have been made other than those requested.

1.9 CONTRACT CLOSE-OUT DOCUMENTS:

- A. Provide close-out submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated, after substantial completion but prior to final observation:

B. Supplementary submittal requirements:

1. Provide the following in one electronic submission for review.
2. Equipment Manuals:
 - a. Manufacturer's owner/instruction manual for each type of Product by manufacturer and model or part number unless specified otherwise herein
 - b. Supply manufacturer's serial numbers for each Product
 - c. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item
 - d. Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
3. Test Reports: Recorded findings of Commissioning.
4. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
 - a. This procedure should describe the operation of system capabilities.
 - b. Assume the intended reader of the manual to be technically inexperienced but unfamiliar with the components and the facility.
5. Service Information, including service phone number(s) and hours; service schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
6. Any other pertinent data generated during the Project or required for future service.
7. Within three weeks of final observation, submit the following in one electronic submission for review. Upon Owners and/or Consultant's request, provide hard copy files of the following:
 - a. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
 - b. Record drawings in AutoCAD editable DWG format and Adobe PDF format. Resolution to be sufficient to permit Owner's technicians to be able to clearly read all notes and text on screen.
 - c. One set of signed proof-of-training documents.
8. Submittal Format:
 - a. Record Drawings: Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'-0".
 - b. Segregate documents into separate folders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in a maintenance folder.
 - c. Project Record Manual
 - 1) Provide product data submittal in a single PDF file.
 - 2) Provide an indexed list of major groupings.
 - 3) In the index, provide clickable hyperlinks that lead to the page of that major grouping.
 - 4) Organize index and major groupings in logical signal-flow order.
9. Resubmission requirements:
 - a. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
 - b. Indicate all changes that have been made other than those requested.

1.10 CUSTOM SOFTWARE

A. Introduction:

1. Proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party proprietary software provided with the system shall be subject to this agreement.
3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this agreement, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:

1. Source code shall be available to Owner for a period of not less than 10 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:

1. Contractor represents and warrants to Owner that:
 - a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;

- b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
 - c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
 3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

1.11 QUALITY ASSURANCE

- A. Qualifications: Contractor to be experienced in the provision of systems similar in complexity to those required for this project, and meet the requirements listed below. Provide documentation at the time of bid to support these qualifications:
 1. Form of corporation.
 2. No less than three years' experience with equipment and systems of the specified types.
 3. Experience with at least three comparable scale projects within the last three years.
 4. Be a franchised dealer and service facility for the manufacturer's products furnished.
 5. Maintain a fully staffed and equipped service facility with full-time field technicians.
 6. Have at least one supervisory on-site employee who has completed and has been certified CTS-I by Infocomm.
 7. Supervision of all rigging by an ETCP certified rigger for all work associated with suspension or mounting of overhead equipment.
 8. Adequate plant capacity and equipment to complete the Work.
 9. Adequate staff with commensurate technical experience.
 10. Suitable financial status (i.e., bonding and materials purchase capacity) to meet the obligations of the Work.
 11. Adequate regional service organization to meet warranty response requirements of the Project.
 12. Provide listing with appropriate explanation regarding the status of Contractor's resolved or unresolved legal disputes within the last six calendar years.
 13. Provide listing with appropriate explanation regarding any projects within the last 3 years where the Contractor has failed to meet construction schedules due to Contractor's cause.
 14. Completed current version of the AIA Contractor's Qualification Form.
- B. Subcontractors: at the time of bid, the Contractor shall provide a list of structural, electrical, sound, or any other subcontractors intended to do the Work, or are being retained as local service providers throughout the warranty period. Subcontractors shall be appropriately state licensed in their specialty and must provide the same qualification documents as the Contractor.
- C. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
 1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.

2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- D. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

1.12 DELIVERY, STORAGE & HANDLING

- A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.
- B. Handling and shipping in accordance with Manufacturer's recommendation.
- C. Provide protective covering during construction of all installed devices, to prevent damaging or entrance of foreign matter.
- D. Replace, at no expense to Owner, Products damaged during storage, handling, or through the course of construction.

1.13 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.14 WARRANTY

- A. Warrant labor and equipment for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or equipment within the Warranty period without charge.
- B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.
- D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Closeout Documents.

- E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment (OFE). Coordinate an observation visit with the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products quantity is as required. If a quantity is given, provide at least the given amount. Some product listed may not be required to fulfill the obligations of the Work.
- B. Equipment and materials shall be new and conform to applicable UL or ANSI provisions.
- C. Regardless of the length or completeness of the descriptive paragraph herein, provide Products complying with the specified manufacturer's published specifications.
- D. Remove or blank out all manufacturers' names, logos, or other symbols from loudspeakers or other objects placed in view of the public. If logos are removable, remove and repaint to the color of the adjacent surface and reattach.
- E. Take care during installation to prevent scratches, dents, chips, etc.

2.2 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed as standard of function, performance, and quality, forming the basis of design.
- B. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.
- C. Where required, provide manufacturer's rack mount adapter or one manufactured by Middle Atlantic or Winstead unless specified elsewhere.

2.3 DIGITAL SIGNAL PROCESSING (DSP) SYSTEM

- A. Signal processing shall be performed by computer-based system.
- B. The DSP system shall be fully operational 60 days prior to the first use of the installed system.
- C. The system shall have the following capabilities:
 - 1. Digital Signal Processing Unit:
 - a. Interior configuration of signal flow and routing to be fully user configurable

- b. Unit to permit hardwire connection of external switches for recalling presets
- c. Unit to have no external user adjustable controls
- d. Dante compatible
- e. Acceptable Product to include the following:
- f. QSC Core 8 Flex (DSP)
- g. QSC SL-QUD-8N-P UCI Deployment Software License
- h. QSC SL-QSE-8N-P QSC Scripting Engine Software License
- i. QSC SL-DAN-32-P QSC 32X32 Software Based Dante License
- j. QSC TSC-70-G3-BK (TP)
- k. QSC TSC-710t-G3 Tabletop mounting accessory for TSC-70-G3

2.4 NETWORK EQUIPMENT

- A. Network Switch (NS):
 - 1. 1RU
 - 2. 28 ports with 4 SFP ports
 - 3. Provide Fiber Optic adaptors as required
 - 4. Acceptable Product:
 - a. Netgear GS728TPv2
- B. SFP Transceiver
 - 1. Multi-mode
 - 2. Acceptable Product:
 - a. Netgear AGM731F

2.5 AMPLIFIERS

- A. Power Amplifiers:
 - 1. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits
 - 2. Frequency response: ± 1 dB, 20 Hz to 20 kHz with less than 1 percent THD at rated output
 - 3. Input impedance: 10 kOhms balanced
 - 4. Output regulation: 2 dB from no load to full load conditions
 - 5. Noise generation: at least 85 dB below rated output with input shorted
 - 6. Ventilation: variable speed fans that shut off when the amplifier is operating under light or no-load conditions
 - 7. Acceptable Products:
 - a. Type 1 Power Amplifier – 4 Channel, 5000 Watts per Channel at 4 Ohms:
 - 1) Dynacord IPX20:4

2.6 LOUDSPEAKERS

- A. Type 20 Loudspeaker:
 - 1. Two 18-inch subwoofer
 - 2. Front-loaded components
 - 3. Omni-directional coverage within intended passband
 - 4. One amplifier channel operation: 4 Ohms nominal impedance
 - 5. 102dB 1W/1M sensitivity
 - 6. 143dB peak SPL

7. 24Hz to 152Hz (-10dB)
8. Outdoor direct exposure certified IP55 rating
9. Provide custom mounting solution
10. Acceptable Product:
 - a. Fulcrum Acoustics SUB218LB-WR (Daktronics A-5177629)

2.7 POWER CONDITIONING

A. Power Protection:

1. Provide surge protection devices to maintain clean power to the following equipment:
 - a. All computer CPU's and associated video monitors
 - b. All Audio System Network equipment
 - c. All low level (mic or line) processing equipment with internal microprocessor or DSP chips
 - d. Mixing Console(s)
2. Acceptable Product:
 - a. Surge-X SX-1120RT
 - b. Furman P-1800 PFR
 - c. Juice Goose RX100

B. Backup Power:

1. Provide UPS systems for:
 - a. Computer CPU's and associated video monitors
 - b. DSP
 - c. Audio related network equipment
 - d. AV Control Systems
2. UPS's shall be on-line style with sufficient battery reserve to operate for 15 minutes. Size each UPS unit for 25 percent additional capacity.
3. Coordinate make and model with the Owner and/or IT Administrator to provide consistency throughout the venue.
4. Acceptable Product:
 - a. Vertiv PSI5-1500RT120LIN

C. Rack Lighting and Power Strip:

1. Nema 20A plug
2. 20 Amp/2400-Watt rating
3. Front panel AC voltmeter
4. Dual front panel pullout dimmable lights
5. Spike and surge suppression with over-voltage shutdown
6. Rack Mountable
7. Acceptable Product:
 - a. Furman PL-Pro C
 - b. Middle Atlantic PDLT-815RVA
 - c. Juice Goose JG 8LED

2.8 AUDIO CONTROL COMPUTER

A. Control Computer

1. Acceptable Product to include the following:
 - a. Dell Optiplex 3RU XE4 Computer with Middle Atlantic custom rack kit (CC)
 - b. Dell P2418HT 24" Touchscreen Monitor

- c. Middle Atlantic RM-LCD-MT Articulating Rack Mount Kit
- d. Daktronics KM 1RU Pull-out Keyboard Mouse Combo USB (KM)

2.9 EQUIPMENT HOUSING & ACCESSORIES

- A. Configure equipment racks for proper airflow and cooling

- B. Middle Atlantic systems listed below are approved for use on this project and are listed to set the acceptable standard of performance. Equipment housing systems from Lowell or other approved equivalents are also acceptable provided they meet the performance specifications of the approved listed equipment housing systems.

- C. Environmental Equipment Rack:
 - 1. Size: 42-inches deep with 44 units of vertical space
 - 2. Provide all necessary side panels, trim pieces, tops, and blank panels
 - 3. Acceptable Product:
 - a. Enclose Manufacturing ENC-11019-3

- D. Rack Drawer:
 - 1. Spring loaded latch
 - 2. Black textured finish
 - 3. Acceptable Product:
 - a. Middle Atlantic TD series

- E. Low Profile Keyboard Shelf:
 - 1. Sliding black laminate shelf
 - 2. Single rack space
 - 3. Acceptable Product:
 - a. Middle Atlantic SSL

- F. Computer Shelf:
 - 1. Flanged construction
 - 2. 16 Gauge steel
 - 3. Black powder coat finish
 - 4. Acceptable Product:
 - a. Middle Atlantic U4

- G. Universal Rack Shelf:
 - 1. Black textured powder coat finish
 - 2. Acceptable Product:
 - a. Middle Atlantic RSU-129

- H. Universal Mounting Trays:
 - 1. Multiple Devices
 - 2. Acceptable Product:
 - a. Extron RSU 126
 - 3. Single Device
 - 4. Acceptable Product:

- a. Extron RSB 126
- I. Blank Rack Panels:
 - 1. Flanged construction
 - 2. 16 Gauge steel
 - 3. Black powder coat finish
 - 4. Acceptable Product:
 - a. Middle Atlantic SB series
- J. Vent Rack Panels:
 - 1. Flanged construction
 - 2. 16 Gauge steel
 - 3. Black powder coat finish
 - 4. Acceptable Product:
 - a. Middle Atlantic VTF series
- K. Rack Fan:
 - 1. 10" or 4.5"(x4), 115V
 - 2. Include cord and hardware
 - 3. Acceptable Product:
 - a. Middle Atlantic FAN10 with GUARD-10
 - b. Middle Atlantic FAN with GUARD
- L. Fan Thermostat Control:
 - 1. Switched 15A duplex outlet
 - 2. Temperature Range: 50 – 90 Degrees
 - 3. On and Stand-by LED indicators
 - 4. Integral mounting ears
 - 5. Provide for each rack fan assembly
 - 6. Acceptable Product:
 - a. Middle Atlantic FC-4-1C
- M. Rack Temperature Display:
 - 1. Provide one display in top front panel space of each rack
 - 2. Decora mount in 1-RU rack panel
 - 3. Digital readout in Fahrenheit or Celsius
 - 4. Connect to DAP GPIO for high temperature alarm to the Audio Control Booth
 - 5. Acceptable Products:
 - a. Middle Atlantic TEMP-DEC with DECP-1X1 Panel.
- N. Rack Light:
 - 1. Provide 60W incandescent or 13W fluorescent work light
 - 2. Located in all equipment racks over 36 RU's high
 - 3. Acceptable Product:
 - a. Middle Atlantic WL-60
 - b. Lowell RL-1
- O. Copper Bus Bars:
 - 1. Material: Solid copper, 1/8 thick and 2-inches wide with threaded 10/32 holes
 - 2. Height: 70-inch for 40-RU or larger racks and 21-inch for racks under 40-RU

3. Wire each circuit ground to bus bar and isolated outlet ground
4. Terminate two #6 wires between rack and buss bar
5. Provide with nylon isolation mounts
6. Provide one bus bar in each rack
7. Acceptable Product:
 - a. Middle Atlantic BB-40
 - b. Middle Atlantic BB-12

P. Equipment Rack Screws:

1. Install rack mounted equipment with black 10-32 star post security screws with flat nylon washers
2. Quantity as required
3. Provide one spare bit located in a clear plastic bag attached to the inside of each equipment rack in plain view
4. Acceptable Product:
 - a. Middle Atlantic HTX
 - b. Raxxess PNTX

2.10 CABLES & WIRING

- A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)
- B. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
- C. Where cables are routed through cable tray, provide tray rated cable of equal specification.
- D. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.
- E. Where cabling is run through in-grade pathways, provide direct burial cable, underground rated, or cable treated with water blocking. Adjust conduit sizes accordingly to accommodate larger diameter cable.
- F. Shielded cables located in raceways shall have aluminum foil shield with drain wire.
- G. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Liberty, Commscope, Gepco, Clark, Windy City, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables.
- H. Loudspeaker Cables:
 1. Amplifier to Rack Room Terminals:
 - a. Distance not to exceed 25 feet.
 - b. 12 gauge twisted pair, jacketed.

- c. Acceptable Product:
 - 1) Belden 5000UP
- 2. Rack Room Terminals to Junction Box Terminals near loudspeaker, low impedance:
 - a. 10 gauge twisted pair, jacketed.
 - b. Acceptable Product:
 - 1) Non-Plenum: Belden 5T00UP
 - 2) Plenum: Belden 6T00UP
 - 3) In-grade: Belden 1313A
- 3. Rack Room Terminals to Junction Box Terminals near loudspeaker, 70V Zones:
 - a. 12 gauge twisted pair, jacketed.
 - b. Acceptable Product:
 - 1) Non-Plenum: Belden 5000UP
 - 2) Plenum: Belden 6000UE
 - 3) In-grade: Belden 1311A
- 4. Drop cable from Junction Box Terminals to Loudspeaker Array:
 - a. Eight conductors, 10 gauge, twisted pairs, SOOW rubber jacketed.
 - b. Acceptable Product:
 - 1) General Cable-Carrol 09008
- 5. Junction Box Terminals to Loudspeaker:
 - a. Distance not to exceed 15 feet.
 - b. 12 gauge, twisted pairs, SOOW rubber jacketed.
 - c. Acceptable Product:
 - 1) General Cable-Carrol 02724 (two-conductor)
 - 2) General Cable-Carrol 02726 (four-conductor)
 - 3) General Cable-Carrol 09208 (eight conductor)

I. Microphone and Line Level Cable:

- 1. Twisted pairs, shielded, jacketed, 110 Ohm cable.
- 2. Acceptable Product:
 - a. Single Pair:
 - 1) Non-Plenum: Belden 1696A
 - 2) Plenum: Belden 1801B
 - 3) Riser: Belden 9451
 - 4) In-grade: Belden 9451WB
 - b. Six Pair:
 - 1) Non-Plenum: Belden 1218B
 - 2) Plenum: Belden 1816P
 - 3) Riser: Belden 1816R
 - 4) In-grade: Belden 1816WB
 - c. Twelve Pair:
 - 1) Non-Plenum: Belden 1220B
 - 2) Plenum: Belden 1818P
 - 3) Riser: Belden 1818R
 - 4) In-grade: Belden 1818WB

J. Wireless Systems Antenna Cable:

- 1. RG8/X
- 2. Acceptable Product:
 - a. Non-Plenum: Belden 9258
 - b. Plenum: Belden 7733A
 - c. Riser: Belden 7810R
 - d. In-grade: Belden 7810WB

K. Ethernet Cable:

1. Category 6 non-bonded pairs
2. Acceptable Product:
 - a. Non-Plenum / Riser: Belden 2412
 - b. Plenum: Belden 1352A
 - c. In-grade: Belden OSP6F
 - d. Tactical: Belden 1303E

L. Fiber Optic Cable:

1. Armored Single Mode Fiber Optic Cable
2. Acceptable Product:
 - a. 6 Strand:
 - 1) Non-Plenum / Riser: Belden FDSH0065F
 - 2) Plenum / In-grade: Belden FDSD006A9
 - b. 12 Strand:
 - 1) Non-Plenum / Riser: Belden FDSH0125F
 - 2) Plenum / In-grade: Belden FDSD012A9
 - c. 24 Strand:
 - 1) Non-Plenum / Riser: Belden FDSH0245F
 - 2) Plenum / In-grade: Belden FDSD024A9
 - d. 48 Strand:
 - 1) Non-Plenum / Riser: Belden FDSH048AK
 - 2) Plenum / In-grade: Belden FDSD048AK

M. Intercom Cable:

1. Low Capacitance 20AWG twisted pair
2. Acceptable Product:
 - a. Non-Plenum: Belden 9207
 - b. Plenum: Belden 89207

N. Category 6A Patch Cables:

1. Rack Patch Cables
2. Length as required
3. Acceptable Product:
 - a. Belden 10GX UTP LSZH series

O. Fiber Patch Cables:

1. Rack Patch Cables
2. Length as required
3. Connector type as required
4. Acceptable Product:
 - a. Belden FP series

2.11 CONNECTORS

A. XLR Panel mount Connectors:

1. Provide panel mount XLR connectors with unified metal shell
2. RF-Protector connectors
3. Shell Color: Black
4. Contacts: Silver
5. Terminations: Solder
6. Acceptable Product:

- a. Male Connectors: Neutrik NC*MD-L-1-BAG Series
 - b. Female Connectors: Neutrik NC*FD-L-1-BAG Series
- B. XLR Cable Connectors:
- 1. Provide XLR cable connectors with die cast shell
 - 2. No-screw type assembly
 - 3. Chuck-type strain relief
 - 4. Shell Color: Black
 - 5. Contacts: Silver
 - 6. Terminations: Solder
 - 7. Acceptable Product:
 - a. Male Connectors: Neutrik NC*MX-BAG Series
 - b. Female Connectors: Neutrik NC*FX-BAG Series.
- C. 1/4" Panel mount Connectors:
- 1. Provide panel mount 1/4" connectors with unified metal shell
 - 2. Shell Color: Black
 - 3. Contacts: Silver
 - 4. Terminations: Solder
 - 5. Acceptable Product:
 - a. Female Connectors: Neutrik NJ3FP6C-BAG Series
- D. 1/4" Cable Connectors:
- 1. Provide 1/4" cable connectors with die cast shell
 - 2. No-screw type assembly
 - 3. Chuck-type strain relief
 - 4. Shell Color: Black
 - 5. Contacts: Nickel
 - 6. Terminations: Solder
 - 7. Acceptable Product:
 - a. Male Connectors: Neutrik NP3C-BAG Series
- E. BNC Cable Connectors:
- 1. Provide cable mount BNC connectors
 - 2. Contacts: Brass or copper
 - 3. Terminations: Crimp
 - 4. Acceptable Product:
 - a. Kings
 - b. Amp
 - c. Amphenol
 - d. Canare
 - e. Liberty
- F. RCA Male Cable Connectors:
- 1. Provide RCA cable connectors with die cast shell
 - 2. Shell Color: Silver
 - 3. Contacts: Silver
 - 4. Terminations: Solder
 - 5. Acceptable Product:
 - a. Switchcraft 3502 Series
 - b. Liberty

- G. F Connector:
1. Provide commercial style gold plated connector with integral sleeve for F6 Series, F11 Series, and F59 Headend cable
 2. Provide seal ring in all moisture intensive environments
 3. Install with manufacturer recommended compression tool
 4. Provide weatherized boots and seal covers for all antenna connections
 5. Verify connector cable type, size and construction with manufacturer
 6. Acceptable Product:
 - a. Gilbert Engineering GF-US-6Q series, GF-US-11Q, and GF-US-59Q series respectively
 - b. Gilbert Engineering Seal ring: G-SR-1/2

- H. RJ45 Connectors:
1. UTP Category 6, 8-pin wiring inserts T568A/B jacks
 2. Acceptable Products:
 - a. Belden PN#AX101320 (color to match plate)

2.12 LOUDSPEAKER HARDWARE AND SUPPORT STRUCTURE

- A. Provide a custom modular loudspeaker hardware system as required to mount and suspend loudspeakers in the arrangement as shown on the Drawings.
- B. Attachment system to be supplied by vendor whose primary specialty is fabricating support systems for loudspeakers or similar devices over an audience.
- C. Acceptable Manufacturers:
1. Adaptive Technologies Group
 2. Polar Focus
 3. Proprietary by loudspeaker manufacturer
- D. Shoulder Type Machinery Eye Bolts:
1. Forged Steel – Shoulder, Quenched and Tempered
 2. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles
 3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements
 4. Select size of product-based working load limits required
 5. Acceptable Product:
 - a. Crosby Group S-279 / M-279 Series
 - b. Chicago Hardware Company 261 Series
 - c. Approved equal
- E. Forged Eye Nuts:
1. Forged Steel – Quenched and Tempered
 2. Tapped with standard UNC class 2 threads after galvanizing
 3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements
 4. Select size of product-based working load limits required.
 5. Acceptable Product:
 - a. Crosby Group G-400 Series

- b. Chicago Hardware Company 167 Series
- c. Approved equal

F. Anchor Shackles:

- 1. Forged - Quenched and tempered, with alloy pin
- 2. Working Load Limit permanently shown on every shackle
- 3. Hot Dip galvanized or Self-Colored
- 4. Product to meet the performance requirements of Federal Specification RR-C-271D Type IVA, Grade A, Class1
- 5. Select size of product-based working load limits required
- 6. Provide all screw pin type shackles with mouse wire
- 7. Acceptable Product:
 - a. Crosby Group G-209 / S-209 Series Screw Pin
 - b. Chicago Hardware Company 201 Series
 - c. Approved equal

G. Turnbuckles:

- 1. Acceptable turnbuckle assembly combinations include: Eye and Eye, Jaw and Jaw, Jaw and Eye
- 2. End fittings are Quenched and Tempered, bodies heat treated by normalizing
- 3. Hot Dip galvanized
- 4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements
- 5. Product to meet the performance requirements of Federal Specifications FF-T-791b, Type 1 Form 1 - CLASS 4, and ASTM F-1145
- 6. Select size of product-based working load limits required
- 7. All end fittings to be moused to the body with mousing cable
- 8. Acceptable Product:
 - a. Eye and Eye:
 - 1) Crosby Group HG-226 Series
 - 2) Chicago Hardware Company 012/013 Series
 - 3) Approved equal
 - b. Jaw and Eye:
 - 1) Crosby Group HG-227 Series
 - 2) Chicago Hardware Company 026 Series
 - 3) Approved equal
 - c. Jaw and Jaw:
 - 1) Crosby Group HG-228 Series
 - 2) Chicago Hardware Company 030/031 Series
 - 3) Approved equal

H. Swivel Hoist Ring:

- 1. All components are Alloy Steel - Quenched and Tempered
- 2. Rated at 100% of Working Load Limit at 90° angle
- 3. 360 swivel and 180 pivot action
- 4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements
- 5. Bolt specification to be Grade 8 Alloy socket head cap screw to ASTM A 574
- 6. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles
- 7. Zinc Plated (Yellow Chromate) finish for increased corrosion protection
- 8. Select size of product-based working load limits required
- 9. Acceptable Product:
 - a. Crosby Group HR-125

- b. Chicago Hardware Company 860 Series
 - c. Approved equal
- I. Wire Rope Thimble:
 - 1. Product to meet the performance requirements of Federal Specification FF-T-276b Type II
 - 2. Hot Dip galvanized
 - 3. Select size of product-based wire rope size required for suspended load
 - 4. Acceptable Product:
 - a. Crosby Group G-411 Series
 - b. Chicago Hardware Company 224/225 Series
 - c. Approved equal
- J. Wire Rope:
 - 1. Strands: 7 x 19 Utility Cable
 - 2. Type: Galvanized
 - 3. Select size of product-based working load limits required
 - 4. Acceptable Product:
 - a. WireCo World Group
 - b. Approved equal
- K. Wire Rope Sleeves:
 - 1. Type: Copper Duplex
 - 2. Select size of product-based wire rope size required for suspended load
 - 3. Acceptable Product:
 - a. WireCo World Group SW-740 Series
 - b. Approved equal

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordination of the Work specified herein with other project work so as to facilitate a cohesive final Product.
- B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.
- C. Mount equipment and enclosures plumb and level.
- D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Installation of cable and wiring

1. Cabling and Wiring:
 - a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and any other restrictions.
 - b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
 - c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
 - d. Horizontal distribution cables shall be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
 - e. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 - f. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
 - g. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.
 - h. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
 - i. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
 - j. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
 - k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
 - l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield(s) that are not connected are to be folded back over the cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
 - m. Isolate cables and wires of different signals or different levels are to be separated, organized, and routed in order to restrict channel crosstalk, or create feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
 - n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed-end connectors crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.

- o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
 - p. Execute wiring in strict adherence to:
 - 1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.
 - 2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.
 - 3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009
2. Equipment Housing Cabling and Wiring:
- a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace, or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag.
 - b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out to their locked position without straining cable.
 - c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
 - d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
 - e. Install with connections completely visible and labeled.
 - f. Provide termination resistors, if required, of 5 percent tolerance. Mount the termination resistors fully visible.
- B. Installation of connectors, plates & panels:
- 1. Install panel mounted connectors rigidly attached to panels, plumb and level.
 - 2. Custom rack panels shall be flanged standard EIA sizes, brushed black anodized finish unless otherwise noted.
 - 3. Custom connector plates (loudspeaker, microphone, etc.lamicoi) are typically stainless steel, unless otherwise noted or specified. However, verify plate finish with the Owner.
 - 4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
 - 5. Other Plates and Panels may be required to satisfy the requirements of the Work.
- C. Installation power and grounding:
- 1. Coordinate final connection of power and ground wiring to housings.
 - 2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
 - 3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
 - 4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.
 - 5. Replace manufacturers supplied 18 gauge IEC power cords with UL listed 18 gauge pre-molded 6", 12", 18", or 24". Use minimum length required. No looped or cable tied IEC power cords will be permitted within the equipment rack.
 - 6. Replace manufacturers supplied 14 gauge IEC power cords with UL listed 14 gauge pre-molded 18" or 36" folamr all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment rack.

D. Installation of electronic equipment:

1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicoïd labels.
4. Mount equipment plumb and level, firmly and safely held in place.

E. Installation of equipment housing:

1. Mount equipment in racks or other project specific equipment housing apparatus. Fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks will be fabricated on site and the reasons for the change.
2. Secure rack mounted devices utilizing all available fastener mounting positions on device.
3. Provide rear support for housing mounted equipment greater than 15 inches deep.
4. Provide blank panels to fill unused panel space within the equipment housing.
5. If Key door locks are required, key each housing type alike.
6. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
7. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
8. If forced-air active thermal management is used, provide ventilation blocking material on the front, sides, and rear of the equipment rack as needed. Reference Middle Atlantic Products "Controlling the Temperature Inside Equipment Racks". Air temperature inside of the rack is not to exceed 90 degrees Fahrenheit.
9. Panels, or equipment mounted on the rear rack rails, shall not block access to any front mounted components.
10. If equipment rack is not equipped with casters, provide two inch high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.

F. Installation of loudspeakers:

1. The Contractor is responsible for final design and engineering of loudspeaker rigging, attachments, brackets, and hoisting.
2. Loudspeakers shall be mounted at the operating position in a safe, secure, and permanent manner.
3. Provide custom rigging as needed. In addition to the ANSI standards below, custom rigging shall be built to include compliance with the following American Welding Society standards:
 - a. AWS-D1.1/D1.1M:2020
 - b. AWS-D1.2/D1.2M:2014
4. Loudspeaker manufacturer supplied mounting brackets or rigging shall be built to the applicable ANSI standards listed below, with testing and/or traceability data provided as part of shop drawings submittal.
5. Suspension and Mounting:
 - a. Static and dynamic equipment loads shall be suspended or mounted in compliance with the following ANSI/ESTA standards, using the latest available versions of the standards:
 - 1) ANSI E1.4-2-2021 Statically Suspended Rigging Systems
 - 2) ANSI E1.56-2018 Rigging Support Points

- 3) ANSI E1.6-1-2021 Powered Hoist Systems
- 4) ANSI E1.8-2012 Loudspeaker Enclosures Intended for Overhead Suspension
- b. Rigging, mounting, and support systems for overhead suspended loudspeakers shall be reviewed and certified by a registered Professional Engineer (PE), in the employ of the Contractor, licensed to practice in the State in which the project is located. Documentation shall be included as a submittal item. Once the systems are installed, the PE shall physically inspect, at the Contractor's cost, the methods and means used to verify compliance with the original design.
- 6. General Guidelines:
 - a. Reference Project structural documents.
 - b. Site and/or special inspections may be required if requested by the Owner.
 - c. Paint loudspeakers, supports, and related hardware color as directed by the Owner.
 - d. The aiming direction of all loudspeakers shall be adjustable by no less than ± 5 degrees horizontally and vertically.
 - e. Loudspeakers are to be oriented parallel to their mounting surface unless otherwise noted.
 - f. Provide a safety cable connected to a secondary location for each loudspeaker.
 - g. All loudspeakers located in ceiling tiles shall be located in the center of the tile unless noted otherwise.
 - h. Paint loudspeakers to match surroundings. Confirm color selection with the Architect during the submittal phase.
 - i. Exterior loudspeaker cabinets shall be constructed of materials designed for permanent outdoor exposure conditions with a minimum IP 54 rating, and a minimum expected 10-year life span. Exterior and interior surfaces of the cabinets shall be protected from the effects of water, moisture, and humidity. The exterior surface shall also be protected from the effects of ultraviolet radiation to prevent fading and color change. The cabinets shall be shaped and oriented in a manner that minimizes the possibility of water pooling on any cabinet surface. Associated hardware shall be inherently non-corrosive, performing to the standards of 304 Stainless Steel or higher.
- G. Installation of projectors:
 - 1. Confirm distance of specified projection lens before mounting projector.
 - 2. Projectors shall be mounted plumb and level at the operating position in a safe, secure, and permanent manner.
 - 3. All hardware required to locate the mount and projector at the required location shall be provided.
 - 4. Projectors shall be mounted using tamper proof secure hardware.
 - 5. Contractor may be required to adjust projection screen, projection screen upper and lower limit switches, and lifts specified elsewhere not installed as part of this Contract.
- H. Installation of flat panel monitors:
 - 1. Confirm location before mounting.
 - 2. Monitors shall be mounted plumb and level at the operating position in a safe, secure, and permanent manner.
 - 3. All hardware required to locate the mount and monitor at the required position shall be provided.
 - 4. Locate monitor on the center line of the room unless noted otherwise.
- I. Outdoor mounting of equipment

1. Objects mounted outdoors and within the building bowl structure shall be properly treated for exposure to moisture and temperature extremes.
2. Mounting hardware shall be non-corrosive or be coated with a corrosion inhibiting layer.
3. Structural supports for loudspeakers, or other equipment, shall have inherent corrosion resistance, or be covered with a corrosion inhibiting layer.
4. Speaker components mounted in exterior environments shall be rigidly connected to the structure to prevent movement caused by wind gusts.
5. Speaker and microphone enclosures to include grille capable of breaking up direct water sprays or rain.
6. Seal all exposed electrical connections on speaker enclosure with waterproof silicone sealant.
7. Treat paper cones of outdoor speakers with silicone based moisture repellent if not factory treated.
8. Provide screened cover over all openings in horn type speakers to keep out birds, insects, or small animals. Screened covering to be stretched with no visible wrinkles.

3.3 FIRESTOP

- A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
- C. Fire-stop systems shall be reviewed by a Professional Engineer (PE) licensed to practice in the State in which the project is located. Stamped drawings showing the fire stop systems shall be included as a submittal item. Once the systems are installed, the engineer of record for the firestop system shall physically inspect the methods and means used to verify compliance with the original design.
- D. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).
- E. All fire-stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for observation by the local authorities prior to cable system acceptance.

3.4 CONTROL SYSTEM PROGRAMMING

- A. Transport Control
 1. Provide standard Stop, Play, Pause, Fast Forward, and Rewind for each playback device and menu control for DVD players. Buttons should be arranged in a conventional fashion that will be familiar to the normal user.

2. The selected control function should be displayed by showing the appropriate button “pressed”. It should remain this way until another function is selected.
3. For devices that will go into a standby mode after a period of time, the control system shall sense this mode and restore normal operating mode once a transport function has been selected. This may require the use of current sensors to determine the state of the unit. No direct user action should be required at the playback device to restore the normal operating mode.

B. Screen/Shade Control

1. In addition to up-down functions, provide a Stop function to allow the movement to be halted. Once movement has been stopped, the up or down buttons should resume travel in the selected direction.
2. Control system shall not prevent screen/shade wall controls from being used as well.
3. Touch panel controls should be readily accessible to the user to permit direct control of shades or screen with having to navigate through multiple control pages.

C. Room Combining

1. Combining of adjacent areas shall be done through a graphical representation of the physical areas to be combined. Use of a floor plan metaphor is recommended with the graphic oriented correctly with respect to control panel location.
2. Use buttons or other appropriate objects placed along the common wall to enable the combining function.
3. When spaces are combined, the graphic appearance of those areas shall change to reflect this configuration. Once an area is separated from a combination, the color of its area should revert to the normal room color.
4. Common control functions between combined rooms shall be linked, allowing control of the combined area from any one of the touch panels. Examples of common functions include:
 - a. Background music selection
 - b. Background music volume
 - c. Background music muting
 - d. Lighting preset recall
 - e. Master volume (not individual channel volume)
5. When combining adjacent rooms, the control system shall force the common functions to a predetermined default configuration so all rooms have the same configuration.
6. To avoid unintentional changes, a control panel will not be able to operate a function in a remote location without also operating that same function in the room where the panel is located.

D. Level Control

1. Objects requiring level adjustment such as volume or tone controls shall be through Up/Down buttons with a graphical representation of the actual level.
2. Increment of level change to be adjusted for reasonable range without the need to push the Up or Down buttons needlessly.

E. Volume Mute

1. Where the ability to mute the sound is needed, the button shall use the label “Vol On” and “VOL OFF” instead of Mute and Unmute. When in a “VOL OFF” mode, pushing the “VOL UP” button shall restore the sound and bring the system out of the muted mode.
2. VOL ON/OFF buttons shall change color to indicate the status of the button.

F. Standard Colors

1. Control functions shall be color coded to add clarity and show relationships between different groups of controls.
2. The color Red shall be reserved to indicate a fault or abnormal condition.
3. Green may be used to indicate normal operation, but may be used for standard control colors as well.
4. Similar controls should maintain the same color scheme across all control pages.
5. When a function is selected, the graphical depiction of that button should appear to be pressed and its color change to a darker shade of the regular button color.
6. Color schemes used for background and foreground objects should be selected to be complimentary and provide a consistent theme throughout the control pages.

G. Minimum Button Size and Placement

1. Minimum visual size of a button is 3/8" wide by 1/4" high.
2. Spacing between buttons should be no less than 1/16".
3. Where buttons are immediately adjacent, the active selection area of the button should be reduced to 80% of the visual area of the button.

H. Button Actions

1. When a function on a control page is selected, that button or visual object associated with that function should change to reflect what has been chosen.
2. For functions that are momentary selections (i.e., VOL UP), the change of state is visible for as long as the button is being pressed.
3. For function that are maintained selections (i.e., PLAY), the change of state remains visible until another function is selected and resets the previous function.
4. The state change of a button or visible object should depict real-world objects as much as possible including the appearance of the button be pressed inward, change in shade of the original color, but not a change in hue.

I. Labels

1. Use of simple words or titles are preferred to indicate functionality, navigation and system status.
2. Use of stylish symbols should be avoided unless their identity is commonly recognized by the general public. Standard symbols for transport functions are acceptable.
3. Labels should be presented in a clear, sans serif type face that will remain legible on lower resolution touch panels.
4. Where physical buttons are present along the side of a touch panel, these buttons should be engraved and filled with a contrasting color.

J. Power On/Off

1. For panels requiring an ON/OFF control, these functions should be linked through current sensors or other methods for the control system to detect the power on condition of the component being controlled.
2. Powering off a system should not interfere with the ability of a projector to complete its cool down cycle.

K. Look & Feel

1. Control pages should utilize a clean, elegant but stylish appearance.
2. Use a common graphical template across all control pages for a consistent look.
3. The touch screen layout should utilize graphical elements such as drop shadows, gradient fills and transparency to provide a pleasing overall appearance.
4. Utilize graphical representations of floor plans to convey location information.

5. Include company logos, icons or watermarks to portray the corporate identity.
6. Provide clear navigation tools for moving between control pages.
7. Each sub-page should have a “BACK” button to return to the previous page. This button should appear in the same location on each page.
8. Provide a “HELP” button or icon on each user page to provide clear, non-technical instructions on how to use the functions available to regular users.

L. Security

1. Provide password access to control pages not intended to be accessed by the general public.
2. Unless otherwise noted, provide a minimum of three levels of access
 - a. General User
 - b. Non-Technical Employee
 - c. AV Technician
3. Segregate the control functions to only allow authorized individuals access to more sophisticated control pages.
4. Provide a timeout feature to automatically return the control panel back to the default opening screen after 30 seconds of inactivity. After this reset, passwords must be reentered to return to a previous control page.

M. Presets

1. For systems that have different operating modes or configurations, provide the ability to store and recall preset combinations of system settings.
2. Provide a “Preset” page that permits a minimum of five presets to be recalled. Each button to include a label describing the function or configuration associated with that button.
3. Provide the ability for new presets to be stored over previous settings. New preset to be able to change the label to reflect the new or revised configuration.
4. When a preset has been recalled, the control page should indicate the active configuration.

3.5 LABELING OF EQUIPMENT

- A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.
- B. Provide logical and legible cable and wiring label permanently affixed for easy identification.
1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
 2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
 3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

3.6 ENGRAVING

- A. Text font: 1/8-inch block sans serif characters unless noted otherwise.

- B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.
- C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.
- D. Equipment label: black with white characters except where indicated.

3.7 COMMISSIONING

- A. Prior to energizing or testing the system, ensure the following:
 - 1. All products are installed in proper and safe manner according to manufacturer's instructions.
 - 2. Insulation and heat shrink tubing are present where required.
 - 3. Dust, debris, wire trimmings, etc. is removed.
 - 4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
 - 5. Labeling has been provided.
 - 6. Temporary facilities and utilities have been properly disconnected and removed.
 - 7. Products are neat, clean, and unmarred. Parts securely attached.
 - 8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired.
- B. Prior to energizing the System, verify and perform the following tests and adjustments in compliance with applicable EIA standards.
 - 1. Electronic devices are properly grounded.
 - 2. Test each AC power receptacle with a circuit checker for proper hot, neutral, and ground connections.
 - 3. Verify each individual component is operating properly.
 - 4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
 - 5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
- C. Loudspeaker Circuit Verification Test
 - 1. Measure the impedance of each loudspeaker line leaving the equipment racks.
 - 2. For constant voltage systems measure the impedance at 100 (or 250) Hz, 1 KHz and 8 (or 10) KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.
 - 3. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
 - 4. Include the results of the tests in the Project Record Manual.
- D. Loudspeaker Polarity Verification Test
 - 1. Use an electronic polarity checker, SysTune, SMAART, or other two-channel FFT measurement system to test each loudspeaker. All loudspeakers should have the same relative polarity.
 - 2. Follow manufacturer's recommendations in conducting the tests.

3. Include the results of the tests in the Project Record Manual.
- E. Audio Signal Paths
1. Verify operation from each source device through all switching, amplification, and distribution devices.
- F. System Gain Adjustment
1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
 2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer. Using an RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Note the dBfs level should be -18dB for digital outputs. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
 3. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
 4. Adjust the output of each component to achieve the proper output level.
 5. Record the output levels of each device in the Project Record Manual.
- G. Signal Delay Adjustment
1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
 2. Using SysTune, SMAART, or other two-channel FFT measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
 3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal. Once the precise delay time has been determined, provide an additional 10 ms of Haas effect delay to maintain directional orientation toward the original sound source.
 4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
 5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.
- H. Remote Input Verification Test
1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
 2. Verify that the receptacle under test appears at the correct input and is operating properly.
 3. In a similar manner, check all remote tielines and media related lines for correct wiring and labeling.
- I. System Equalization
1. Using SysTune, SMAART, or other two-channel FFT measurement system, equalize all loudspeaker systems to provide a suitable frequency response as follows:
 - a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above. Adjust initial settings as necessary for best intelligibility

- b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB per octave roll off above. Adjust subwoofer level to +6dB above man speakers from 35Hz to Hz. Adjust initial settings to optimize audio quality.
 - 2. Verify system gain and amplifier levels.
 - 3. Provide program levels of at least 95 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
 - 4. Provide hard copy printouts of the spectral response with the test data.
- J. RFI and Parasitic Oscillation
 - 1. With systems operating, check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.
- K. Buzzes, Rattles, and other Distortions
 - 1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles, and other objectionable distortions.
 - 2. Correct the cause of the defect. If the cause is not from the system, bring the cause to the attention of the Owner, indicating cause and suggestive corrective actions.
- L. Video Systems Test
 - 1. Projected images and screen must be plumb with respect to ceiling line.
- M. Video System Tests. Verify performance of all video equipment, components, and systems, as specified herein.
 - 1. Video (signal):
 - a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
 - b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
 - c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
 - d. Line and Field Tilt: 2% maximum.
 - e. Differential Gain: 2% maximum.
 - f. Differential Phase: 2 degrees maximum.
 - g. Frequency Response: DC to 4.2 MHz within plus or minus 0.5 dB.
- N. Video Signal Paths
 - 1. Verify operation from each source device through all switching, amplification, and distribution devices.
- O. Video Test Report shall include the following:
 - 1. Test Failures and Notices
 - a. Sink Device EDID Test – Open items or failures shall not be accepted.
 - b. Cable Length Test – Open items or failures shall not be accepted.
 - c. HDCP KSV Limitations – Limitations shall not be accepted.
 - d. Cable Limitations - Limitations shall not be accepted.
 - e. EDID Limitations - Limitations shall not be accepted.
 - f. Cable Length Limits exceeded – Failing cables shall not be accepted.
 - 2. Device Model Number, Serial Number, and Firmware Version for main chassis and each input and output card.
 - 3. Device Model Number, Serial Number, and Firmware Version for connected transmitter and receiver devices.
 - 4. EDID – Input Resolution and 3D support status for each input.

5. EDID – Supported Output Resolution and 3D support status for devices connected to each output.
6. EDID – Supported Audio formats for each input.
7. EDID – Supported Audio formats for devices connected to each output.

P. Control Systems

1. Verify operational functions of the control system and all interfaced devices.
2. Verify operational functionality of any wireless user devices.

3.8 CAT5E/CAT6 CABLE CERTIFICATION

A. General Field Test Requirements

1. All CAT5E/CAT6 cabling links installed as part of this scope shall be tested for the following, in accordance with the field test specifications defines in ANSI/TIA-568-C.2 “Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard.” This document will be referred to as the “Category 5e Standard”:
 - a. Wire Map
 - b. Length
 - c. Insertion Loss
 - d. NEXT loss
 - e. PS NEXT Loss
 - f. ACR-F Loss
 - g. PS ACR-F Loss
 - h. Return Loss
 - i. Propagation Loss
 - j. Delay Skew
2. The installed twisted-pair horizontal links shall be tested from terminated end point to terminated end point for compliance with the “Permanent Link” performance specification as defined in the Category 5e Standard.
3. One hundred percent of the installed cabling links must pass the requirements of the Category 5e standard mentioned above and as further detailed in Section B below. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Section C below.
4. The test equipment (tester) shall comply with the accuracy requirements for level IIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 2 of ANSI/TIA-1152 (Table 2 in this TIA document also specifies the accuracy requirements for the channel configuration).
5. The RJ45 test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.
6. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
7. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

8. The Pass or Fail condition of the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass.
9. A Pass or Fail result for each parameter is determined by comparing the measured values with the specifies test limits for that parameter.

B. Performance Test Parameters

1. The test parameters are defined by the Category 6A Standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 100 MHz) must meet or exceed the limit value determined in the above mentioned standard.
2. Wire Map - Shall report Pass if the wiring of each wire-pair from end to end is determined to be correct.
3. Length – The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP. The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.
4. Insertion Loss (Attenuation) – Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 100 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk Ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results of the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which the worst case value occurs, and the test limit value at this frequency.
5. NEXT Loss – Pair-to-pair near end crosstalk loss (abbreviated as NEXT loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 100 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT loss measurements shall not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
6. Table 1 – Maximum frequency step size as defined in ANSI/TIA-1152

Frequency Range (MHz)	Maximum Step Size (MHz)
1-31.25	0.15
31.26-100	0.25

7. NEXT Loss – Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 100 MHz and the step size may not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Maximum test results documentation (summary

- results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS next. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
8. ACR-F Loss, pair to pair – Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured 1 through 100 MHz and the maximum step size for FEXT loss measurements shall not exceed the maximum step size defined as the standard as in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value for ACR-F. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
 9. PS ACR-F Loss – Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs of the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
 10. Return Loss – Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst value of Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
 11. Propagation Delay – Propagation delay is the time required for the signal to travel from one of the links to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
 12. Delay Skew – [as defined in the Category 5e Standard; Section 6.2.19] This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

C. Test Result Documentation

1. The test results/measurements shall be transferred into a Windows based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time.

2. The database for the completed job shall be stored and delivered electronically, including the software tools required to view, inspect, and print any selection of test reports.
3. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
 - a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.
 - c. The date and time the test results were saved in the memory of the tester.
4. General information to be provided in the electronic data base with the test results information for each link:
 - a. The identification of the customer site as specified by the end-user.
 - b. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - c. The overall Pass/Fail evaluation of the link-under-test
 - d. The name of the test limit selected to execute the stored test results
 - e. The cable type and value of NVP used for length calculations
 - f. The date and time the test results were saved in the memory of the tester
 - g. The brand name, model, and serial number of the tester.
 - h. The identification of the tester interface
 - i. The revision of the tester software and the revision of the test limits database in the tester
 - j. The test results information must contain information on each of the required test parameters that are listed in Section B and as further detailed below under paragraph C5.
5. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. The PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.
6. The detailed test results data to be provided in the electronic database must contain the following information:
 - a. Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m330 and test limit value.
 - b. Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
 - c. Delay Skew: Identify the pair with the largest value for delay skew, the value measured in nanoseconds (ns) and the test limit value.
 - d. Insertion Loss (Attenuation): Minimum test results documentation as explained in Section B for the worst pair.
 - e. Return Loss: Minimum test results documentation as explained in Section B for the worst pair as measured from each end of the link.
 - f. NEXT, ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.
 - g. PS NEXT and PS ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.

3.9 FINAL OBSERVATION & TESTING

- A. Upon completion of installation, initial adjustments, tests, and measurements specified in Part 3, and submission and review of the results, a final observation and test will be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.

- B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.
- C. The process of testing the System may necessitate moving and adjusting certain components.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.
- E. The following procedures will be performed on each System:
 1. Observation of the methods and means employed to incorporate the System within the facility.
 2. Verification of proper operation, from controlling devices to controlled devices.
 3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
 4. Other tests on equipment or systems deemed appropriate.
- F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.10 TEST EQUIPMENT

- A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers, and calibration dates that will be used.
- B. The following equipment shall be available on site for the entire test period through final system testing.
 1. Sound Level Meter: ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
 2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, ± 1 dB (long-term average) at 0 dBm output. Stability: ± 2 dB per day.
 3. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100 kohms.
 4. Audio Oscillator: bandwidth 20 Hz to 20k Hz ± 5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from -30 dBu to $+10$ dBu.
 5. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
 6. NTSC Test generator
 7. Sound system measurement and alignment system
 - a. SysTune, SMAART, or other two-channel FFT measurement system, with industry standard measurement microphones. Provide adequate microphone cabling for the venue size, or a wireless microphone system qualified for use with a test measurement system. Provide one microphone stand with each microphone.

8. Video (analog) test generator capable of generating signal up to 1920 x 1200 with audio.
9. Video (digital) test generator capable of generating signal up to 1920 x 1200 with audio.
10. Two-way radios to connect personnel in the equipment room(s) with personnel in other areas of the site for coordinated systems test and setup.
11. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

3.11 INSTRUCTION OF OWNER PERSONNEL

- A. Provide 8 hours instruction to Owner designated personnel focusing on the use, operation, and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative.
- B. Video record all training sessions and compile a training video to be provided to the Owner electronically.
- C. Provide sign in sheet to document the attendee's presence.
- D. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.
- E. Provide on-site event support for 4 events, chosen at the discretion of the Owner, by a technician fully knowledgeable and qualified in sound system operation, programming, and troubleshooting.

3.12 CLEANUP AND REPAIR

- A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION 27 41 16

NORTH ENDZONE VIDEO BOARD REPLACEMENT - APPENDIX E1

FAUROT FIELD AT MEMORIAL STADIUM
UNIVERSITY OF MISSOURI – COLUMBIA
HEI PROJECT NO: 2350004894
UNIVERSITY PROJECT NO: CP241291

DATE: FRIDAY, MARCH 22, 2024

This report covers the electrical scope impact for the replacement of the existing north endzone video board, built in 2009, for Faurot Field at Memorial Stadium for the University of Missouri. The video board manufacturer, Daktronics, provided a basis of design that was used to calculate the loads below. If the basis of design were to change, the loads and electrical distribution will need to be reevaluated.

EXISTING CONDITIONS

1. EXISTING DISTRIBUTION

- A. An existing 750 kVA, 208Y/120V/3P service transformer is located approximately 100 feet to the northwest of the existing video board. The transformer serves the north video board as well as the team store, ticket office and concessions in the north endzone plaza. Over the past 5 years, the peak demand on the transformer is 282 kVA.
- B. A 1200A main disconnect is located adjacent to the transformer and serves a 1000A, 208Y/120V/3P distribution panel located in the west side base of the video board.
- C. Audio amplifiers for the north video board are located in an electrical/AV room approximately 75' northeast of the video board.
 1. The existing service transformer serves (2) 600A, 208Y/120V/3P panelboards in the AV closet named P1N-NE-A and P1N-NE-B.
 2. Additionally, there is (1) 225A rated, 208Y/120V/3P panelboard named P1E-NE-A supplied by the generator that is limited to 30 kVA based on the normal side distribution transformer. Based on the existing circuit breakers, it has a load of no more than 21.1 kVA.
 3. A 225A rated, 480Y/277V/3P panelboard named P3N-NE-A supplied by a 30 kVA step-up distribution transformer is located in the AV room, however, it is no longer in use.
 4. The existing audio system is estimated to have a load of 55 kW and produce a heat load of 92,000 btu/hr.

2. EXISTING VIDEO BOARD

- A. The 1000A distribution board has 3 branch circuit breakers. An 800A, 208Y/120V/3P circuit breaker with a load of 201.1 kVA feeds panel RP2_1. A 200A, 208Y/120V/3P circuit breaker with a load of 56.2 kVA feeds panel MD2_1. An additional 125A, 208V/1P circuit breaker feeds AT&T telecommunications equipment.
- B. Panel RP2_1 supplies branch circuit breakers to the front video board, closed captioning video board and relief fans. Panel MD2_1 supplies branch circuit breakers to the rear video board, audio equipment, fixed digit scoreboard, play clock, catwalk lights and receptacles.
- C. Based on the existing drawings, the existing loads are as follows:

RP2_1	
1. Front Video Board	159.7 kVA
2. Closed captioning video board	6.5 kVA
3. Relief fans	34.8 kVA
	201 kVA total

	MD2_1	
1.	Rear Video Board	36.5 kVA
2.	Audio Equipment	7.7 kVA
3.	Fixed digit scoreboard & play clock	1.9 kVA
4.	Catwalk lights & receptacles	10.1 kVA
		56.2 kVA total

- D. Note that video boards are the maximum power draw with full white display and full brightness. Under normal conditions aside from initial testing, the load will be less.

PROPOSED DESIGN

1. EXISTING EQUIPMENT TO REMAIN OR REPLACE

- A. The existing relief fans and play clock are all existing to remain. The existing audio equipment will remain, with new audio equipment to be added.
- B. The existing rear video board is to be replaced in kind. The fixed digit scoreboard will be removed and the front video board will be replaced with a larger video board that encompasses the fixed digit scoreboard and extends 6' on both sides. The closed captioning video board will be replaced in kind. Finally, the catwalks will likely be extended, requiring additional lights and receptacles.

2. PROPOSED NEW VIDEO BOARD

- A. Based on the proposed equipment from Daktronics, the new loads are as follows:

	RP2_1	
1.	Front Video Board	130 kVA
2.	Closed captioning video board	4.5 kVA
3.	Rear Video Board	24.3 kVA

	MD2_1	
1.	Remove Rear Video Board	-36.5 kVA

- B. The new load on panel RP2_1 will be 193.6 kVA. The new load on MD2_1 will be 19.7 kVA, with some minor additional loads for the extended catwalk and potential audio system upgrades.

3. PROPOSED NEW AUDIO SYSTEM

- A. The new audio equipment will require approximately 30 kW and create an additional 40,000 btu/hr of heat.
- B. With the spare capacity available in the new video board, the new AV rack shall be located in the video board structure with power supplied by the existing 1000A distribution board.

SUMMARY

1. ELECTRICAL DISTRIBUTION

- A. Based on the proposed loads, the overall power requirements of the video board will be less than the existing video board. As a result, the existing service transformer and 1000A distribution panel are sufficient for the new work.
- B. New audio equipment will be installed within the video board structure. New branch circuit breakers and cooling equipment will be in Daktronics scope of work.
- C. Any work required for panels RP2_1 and MD2_1 or the 1000A distribution panel, such as revised or new branch circuit breakers, will be in Daktronics scope of work.

SITE PHOTOS

Service Transformer



Existing Video Board (front)



Existing Video Board (rear)



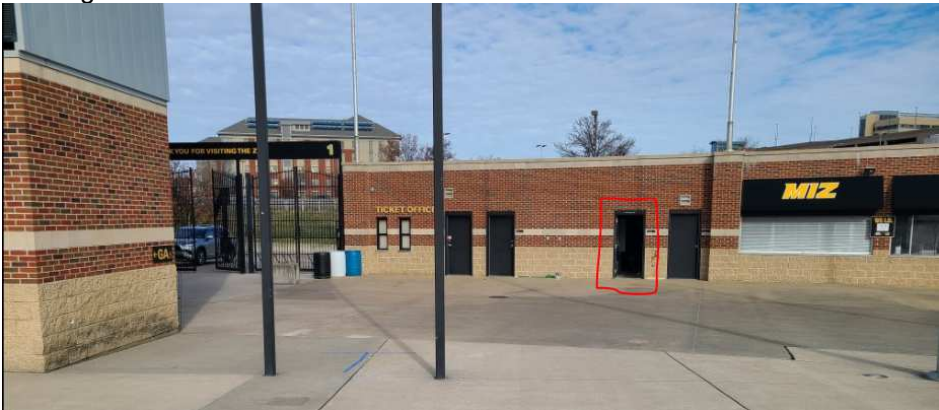
Existing Distribution Panel



Existing MD2 1 (left) and RP2 1 (right)



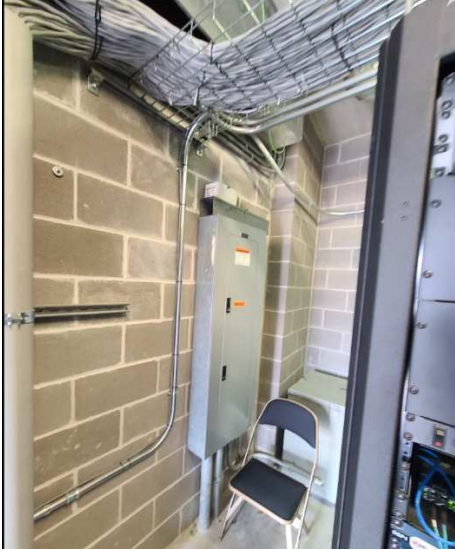
Existing AV room location



Existing AV room electrical distribution



Existing AV room electrical distribution (cont)



Existing AV room electrical distribution (cont)

