



PARAGON
ARCHITECTURE

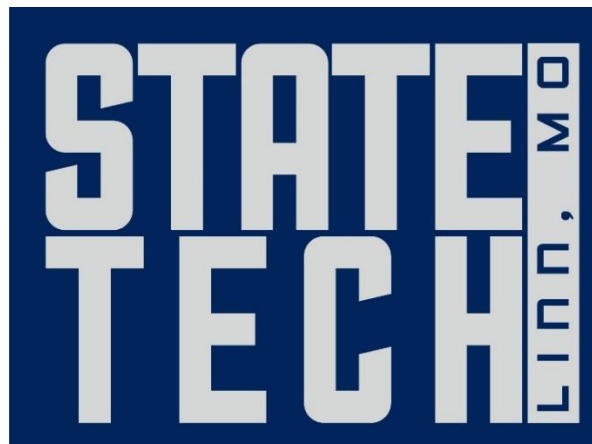
**PROJECT MANUAL
VOLUME 1 OF 2**

**STATE TECH
UTILITY TECHNICIAN CENTER PHASE B**

**ONE TECHNOLOGY DRIVE
LINN, MO 65051**

Project # 21-626

**BID SET DOCUMENTS
Issue Date | MAY 25, 2021**



STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

PROJECT MANUAL

PROJECT:

State Tech Utility Technician Center
One Technology Drive
Linn, MO 65051

OWNER:

Regents of State Technical College of Missouri
One Technology Drive
Linn, MO 65051

ARCHITECT OF RECORD:

PARAGON ARCHITECTURE

449 N. Euclid Ave.
Suite 100
St. Louis, MO 63108
Phone: 417.885.0002

Project Contact: Tracy Collins

CIVIL ENGINEER OF RECORD:

TOTH & ASSOCIATES

1550 E. Republic Road
Springfield, MO 65804
Phone: 417.888.0645

Project Contact: Matt Miller

STRUCTURAL ENGINEER OF RECORD:

TOTH & ASSOCIATES

1550 E. Republic Road
Springfield, MO 65804
Phone: 417.888.0645

Project Contact: Brian Orr

**MECHANICAL/ELECTRICAL/PLUMBING/
FIRE PROTECTION/TECHNOLOGY/AV ENGINEER OF RECORD:**

IMEG CORP.

15 Sunnen Drive
Suite 104
St. Louis, MO 63143
Phone: 314.645.1132

Project Contact: Russell Arneson

TABLE OF CONTENTS

VOLUME 1 OF 2

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 00	SPECIFICATION DISCLAIMER – PARAGON ARCHITECTURE
00 01 01	SPECIFICATION DISCLAIMER – TOTH & ASSOCIATES CIVIL
00 01 02	SPECIFICATION DISCLAIMER – TOTH & ASSOCIATES STRUCTURAL
00 01 03	SPECIFICATION DISCLAIMER – IMEG CORPORATION
00 01 13	ADVERTISEMENT FOR BIDS
00 21 13	INSTRUCTION TO BIDDERS
00 26 00	PROCUREMENT SUBSTITUTION PROCEDURES

DIVISION 01 – GENERAL REQUIREMENTS

01 10 00	SUMMARY
01 21 00	ALLOWANCES
01 25 00	SUBSTITUTION PROCEDURES
01 26 00	CONTRACT MODIFICATION PROCEDURES
01 27 00	UNIT PRICES
01 29 00	PAYMENT PROCEDURES
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 33 00	SUBMITTAL PROCEDURES
01 40 00	QUALITY REQUIREMENTS
01 42 00	REFERENCES
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 73 00	EXECUTION
01 77 00	CLOSEOUT PROCEDURES
01 78 23	OPERATION AND MAINTENANCE DATA
01 78 39	PROJECT RECORD DOCUMENTS
01 79 00	DEMONSTRATION AND TRAINING

DIVISION 02 – DEMOLITION

02 41 00	DEMOLITION
02 41 13	SITE DEMOLITION

DIVISION 03 – CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE
03 05 16	UNDERSLAB VAPOR BARRIER
03 35 11	CONCRETE FLOOR FINISHES

DIVISION 04 - MASONRY

04 20 00	UNIT MASONRY
04 20 01	MASONRY VENEER
04 72 00	CAST STONE MASONRY

DIVISION 05 – METALS

05 40 00	COLD FORMED METAL FRAMING
05 50 00	METAL FABRICATIONS
05 75 00	DECORATIVE FORMED METAL

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

06 10 10 NON-STRUCTURAL ROUGH CARPENTRY

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 13 00 SHEET WATERPROOFING
07 19 00 WATER REPELLENTS
07 21 00 THERMAL INSULATION
07 62 00 SHEET METAL FLASHING AND TRIM
07 72 00 ROOF ACCESSORIES
07 84 00 FIRESTOPPING
07 92 00 JOINT SEALANTS

DIVISION 08 – OPENINGS

08 06 71 DOOR HARDWARE SCHEDULE
08 11 13 HOLLOW METAL DOORS AND FRAMES
08 36 13 SECTIONAL DOORS
08 43 13 ALUMINUM-FRAMED STOREFRONTS
08 44 13 GLAZED ALUMINUM CURTAIN WALLS
08 71 00 DOOR HARDWARE
08 80 00 GLAZING
08 87 17 SECURITY GLAZING FILM

DIVISION 09 – FINISHES

09 21 16 GYPSUM BOARD ASSEMBLIES
09 22 16 NON-STRUCTURAL METAL FRAMING
09 30 00 TILING
09 51 00 ACOUSTICAL CEILINGS
09 65 00 RESILIENT FLOORING
09 91 13 EXTERIOR PAINTING
09 91 23 INTERIOR PAINTING

DIVISION 10 - SPECIALTIES

10 11 00 VISUAL DISPLAY UNITS
10 14 00 SIGNAGE
10 26 00 WALL AND DOOR PROTECTION
10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES
10 44 00 FIRE PROTECTION SPECIALTIES

DIVISION 12 - FURNISHINGS

12 24 00 WINDOW SHADES
12 32 00 MANUFACTURED WOOD CASEWORK
12 36 00 COUNTERTOPS

DIVISION 13 – SPECIAL CONSTRUCTION

13 34 19 METAL BUILDING SYSTEMS

DIVISION 21 – FIRE SUPPRESSION

21 05 00 BASIC FIRE SUPPRESSION REQUIREMENTS
21 05 29 FIRE SUPPRESSION SUPPORTS AND ANCHORS
21 05 50 SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
21 05 53 FIRE SUPPRESSION IDENTIFICATION
21 13 00 FIRE PROTECTION SYSTEMS
21 30 00 FIRE PUMPS

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

DIVISION 22 – PLUMBING

22 05 00	BASIC PLUMBING REQUIREMENTS
22 05 13	MOTORS
22 05 16	PLUMBING EXPANSION COMPENSATION
22 05 29	PLUMBING SUPPORTS AND ANCHORS
22 05 48	PLUMBING VIBRATION ISOLATION
22 05 50	SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
22 05 53	PLUMBING IDENTIFICATION
22 07 16	PLUMBING EQUIPMENT INSULATION
22 07 19	PLUMBING PIPING INSULATION
22 09 00	INSTRUMENTATION
22 10 00	PLUMBING PIPING
22 10 30	PLUMBING SPECIALTIES
22 11 23	DOMESTIC WATER PUMPS
22 30 00	PLUMBING EQUIPMENT
22 40 00	PLUMBING FIXTURES

VOLUME 2 OF 2

DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

23 05 00	BASIC HVAC REQUIREMENTS
23 05 13	MOTORS
23 05 48	HVAC VIBRATION ISOLATION
23 05 50	SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
23 05 53	HVAC IDENTIFICATION
23 05 93	TESTING, ADJUSTING, AND BALANCING
23 07 13	DUCTWORK INSULATION
23 09 00	CONTROLS
23 09 13	INSTRUMENTATION
23 23 00	REFRIGERATION PIPING AND SPECIALTIES
23 31 30	DUCTWORK
23 33 00	DUCTWORK ACCESSORIES
23 34 23	POWER VENTILATORS
23 36 00	AIR TERMINAL UNITS
23 37 00	AIR INLETS AND OUTLETS
23 40 00	AIR CLEANING
23 73 13	INDOOR MODULAR AIR HANDLING UNITS
23 82 00	TERMINAL HEAT TRANSFER UNITS
23 82 16	AIR COILS

DIVISION 26 – ELECTRICAL

26 05 00	BASIC ELECTRICAL REQUIREMENTS
26 05 13	WIRE AND CABLE
26 05 26	GROUNDING AND BONDING
26 05 33	CONDUIT AND BOXES
26 05 48	SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
26 05 53	ELECTRICAL IDENTIFICATION
26 05 73	POWER SYSTEM STUDY
26 20 00	SERVICE ENTRANCE
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

26 28 16	DISCONNECT SWITCHES
26 29 23	VARIABLE FREQUENCY DRIVES
26 51 00	LIGHTING
26 52 00	EMERGENCY LIGHTING EQUIPMENT

DIVISION 27 – COMMUNICATIONS

27 05 00	BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS
27 05 26	COMMUNICATIONS BONDING
27 05 28	INTERIOR COMMUNICATION PATHWAYS
27 05 43	EXTERIOR COMMUNICATION PATHWAYS
27 05 53	IDENTIFICATION AND ADMINISTRATION
27 11 00	COMMUNICATION EQUIPMENT ROOMS
27 13 00	BACKBONE CABLING REQUIREMENTS
27 15 00	HORIZONTAL CABLING REQUIREMENTS
27 17 10	TESTING
27 17 20	SUPPORT AND WARRANTY

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 05 00	BASIC SAFETY AND SECURITY SYSTEMS REQUIREMENTS
28 13 00	ELECTRONIC ACCESS CONTROL
28 23 00	VIDEO SURVEILLANCE
28 31 00	FIRE ALARM AND DETECTION SYSTEM

DIVISION 31 - EARTHWORK

31 10 00	SITE CLEARING
31 23 00	EXCAVATION AND FILL
31 25 00	EROSION AND SEDIMENTATION CONTROLS
31 31 16	TERMITE CONTROL

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 00	CAST-IN-PLACE CONCRETE FOR SITEWORK
32 13 73	CONCRETE PAVING JOINT SEALANTS
32 92 00	TURF AND GRASSES

DIVISION 33 – UTILITIES

33 05 26	UTILITY IDENTIFICATION
33 10 00	WATER UTILITY DISTRIBUTION
33 31 00	SEWER UTILITY PIPING
33 41 00	STORM UTILITY PIPING

APPENDIX A

A1	BID PROPOSAL FORM
A2	STATEMENT OF BIDDERS QUALIFICATIONS
A3	E-VERIFY AFFIDAVIT

APPENDIX B

B1	CSI FORM 1.5C SUBSTITUTION REQUEST FORM (DURING BIDDING)
B2	CSI FORM 13.1A SUBSTITUTION REQUEST FORM (POST BIDDING)
B3	OWNER-CONTRACTOR CONTRACT (DRAFT)
B4	SUPPLEMENTARY CONDITIONS TO THE A201 (DRAFT)
B5	EXHIBIT A: INSURANCE REQUIREMENTS (DRAFT)
B6	MISSOURI PREVAILING WAGE ORDER – OSAGE COUNTY, MO. – AWO#28

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B7	N/A
B8	CONTRACTOR PAYROLL REPORT (SAMPLE)
B9	AFFIDAVIT OF COMPLIANCE (SAMPLE)
B10	5060 PROJECT TAX EXEMPT CERTIFICATE (SAMPLE)
B11	GEOTECHNICAL ENGINEERING REPORT
B12	FOR REFERENCE ONLY – PHASE A PEMB AS-BUILT DRAWINGS
B13	FOR REFERENCE ONLY – PHASE A SWITCHGEAR SHOP DRAWINGS
B14	FOR REFERENCE ONLY – PHASE A FIRE SUPPRESSION SYSTEM SHOP DRAWINGS

END OF TABLE OF CONTENTS

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

ARCHITECTURAL SPECIFICATION DISCLAIMER

PROJECT: State Technical College of Missouri – Utility Technician Center Phase B
OWNER: State Technical College of Missouri
LOCATION: One Technology Drive, Linn, MO 65051

ARCHITECT: Paragon Architecture, LLC
637 W. College Street, Springfield, MO 65802
449 North Euclid Avenue, Suite 100, St. Louis, MO 63108
Phone: 417.885.0002

The Specifications to be authenticated by Paragon Architecture and the undersigned seal is limited to the specification sections listed below. Paragon Architecture hereby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Paragon Architecture, LLC.

Copyright **2021**; The specifications listed below are instruments of service and are property of Paragon Architecture, LLC. This work is protected under U.S. Copyright Law and the Architectural Works Copyright Act of 1990. Failure to compensate Paragon Architecture constitutes copyright infringement.

00 01 13	ADVERTISEMENT FOR BIDS
00 21 13	INSTRUCTION TO BIDDERS
00 26 00	PROCUREMENT SUBSTITUTION PROCEDURES
01 10 00	SUMMARY
01 21 00	ALLOWANCES
01 25 00	SUBSTITUTION PROCEDURES
01 26 00	CONTRACT MODIFICATION PROCEDURES
01 27 00	UNIT PRICES
01 29 00	PAYMENT PROCEDURES
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 33 00	SUBMITTAL PROCEDURES
01 40 00	QUALITY REQUIREMENTS
01 42 00	REFERENCES
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 73 00	EXECUTION
01 77 00	CLOSEOUT PROCEDURES
01 78 23	OPERATION AND MAINTENANCE DATA
01 78 39	PROJECT RECORD DOCUMENTS
01 79 00	DEMONSTRATION AND TRAINING
02 41 00	DEMOLITION
03 30 99	UNDERSLAB VAPOR BARRIER
03 35 11	CONCRETE FLOOR FINISHES
04 20 01	MASONRY VENEER
04 72 00	CAST STONE MASONRY
05 50 00	METAL FABRICATIONS
05 75 00	DECORATIVE FORMED METAL
06 10 10	NON-STRUCTURAL ROUGH CARPENTRY
07 13 00	SHEET WATERPROOFING
07 19 00	WATER REPELLENTS
07 21 00	THERMAL INSULATION



STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

07 62 00	SHEET METAL FLASHING AND TRIM
07 72 00	ROOF ACCESSORIES
07 84 00	FIRE STOPPING
07 92 00	JOINT SEALANTS
08 06 71	DOOR HARDWARE SCHEDULE
08 11 13	HOLLOW METAL DOORS AND FRAMES
08 36 13	SECTIONAL DOORS
08 43 13	ALUMINUM FRAMED STOREFRONTS
08 44 13	GLAZED ALUMINUM CURTAIN WALLS
08 71 00	DOOR HARDWARE
08 80 00	GLAZING
08 87 17	SECURITY GLAZING FILM
09 21 16	GYPSUM BOARD ASSEMBLIES
09 22 16	NON-STRUCTURAL METAL FRAMING
09 30 00	TILING
09 51 00	ACOUSTICAL CEILINGS
09 65 00	RESILIENT FLOORING
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
10 11 00	VISUAL DISPLAY UNITS
10 14 00	SIGNAGE
10 26 00	WALL AND DOOR PROTECTION
10 28 00	TOILET, BATH, AND LAUNDRY ACCESSORIES
10 44 00	FIRE PROTECTION SPECIALTIES
12 24 00	WINDOW SHADES
12 32 00	MANUFACTURED WOOD CASEWORK
12 36 00	COUNTERTOPS
13 34 19	METAL BUILDING SYSTEMS
31 31 16	TERMITE CONTROL
A1	BID PROPOSAL FORM
A2	STATEMENT OF BIDDERS QUALIFICATIONS
A3	E-VERIFY AFFIDAVIT
B1	CSI FORM 1.5C SUBSTITUTION REQUEST DURING BIDDING
B2	CSI FORM 13.1A SUBSTITUTION REQUEST POST-BIDDING
B3	OWNER-CONTRACTOR CONTRACT (DRAFT)
B4	SUPPLEMENTARY CONDITIONS TO OWNER-CONTRACTOR CONTRACT
B5	A101-2017 EXHIBIT A INSURANCE AND BONDS
B6	MISSOURI PREVAILING WAGE ORDER #28 (OSAGE COUNTY)
B7	STATE TECHNICAL COLLEGE TAX EXEMPT STATUS
B8	U.S. DEPARTMENT OF LABOR – WH347 (SAMPLE PAYROLL FORM)
B9	PW-R AFFIDAVIT OF COMPLIANCE (SAMPLE)
B10	5060 PROJECT EXCEPT CERT (SAMPLE)
B11	GEOTECHNICAL ENGINEERING REPORT
B12	FOR REFERENCE ONLY - PHASE A PRE-ENGINEERED METAL BUILDING SHOP DRAWINGS
B13	FOR REFERENCE ONLY – PHASE A SWITCHGEAR SHOP DRAWINGS
B14	FOR REFERENCE ONLY – PHASE A FIRE SUPPRESSION SYSTEMS SHOP DRAWINGS

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

CIVIL SPECIFICATION DISCLAIMER

PROJECT: State Technical College of Missouri – Utility Technician Center Phase B
OWNER: State Technical College of Missouri
LOCATION: One Technology Drive, Linn, MO 65051

MEP ENGINEER: Toth & Associates
1550 E. Republic Road
Springfield, MO 65804

The Specifications to be authenticated by Toth & Associates and the undersigned seal is limited to the specification sections listed below. Toth & Associates hereby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Toth & Associates.

Copyright **2021**; The specifications listed below are instruments of service and are property of Toth & Associates. This work is protected under U.S. Copyright Law and the Architectural Works Copyright Act of 1990. Failure to compensate Toth & Associates constitutes copyright infringement.

DIVISION 02 – DEMOLITION
02 41 13 SITE DEMOLITION

DIVISION 31 – EARTHWORK
31 10 00 SITE CLEARING
31 23 00 EXCAVATION AND FILL
31 25 00 EROSION AND SEDIMENTATION CONTROLS

DIVISION 32 – EXTERIOR IMPROVEMENTS
32 11 00 CAST-IN-PLACE CONCRETE FOR SITEWORK
32 13 73 CONCRETE PAVING JOINT SEALANTS
32 92 00 TURF AND GRASSES

DIVISION 33 – UTILITIES
33 05 26 UTILITY IDENTIFICATION
33 10 00 WATER UTILITY DISTRIBUTION
33 31 00 SEWER UTILITY PIPING
33 41 00 STORM UTILITY PIPING



STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

STRUCTURAL SPECIFICATION DISCLAIMER

PROJECT: State Technical College of Missouri – Utility Technician Center Phase B
OWNER: State Technical College of Missouri
LOCATION: One Technology Drive, Linn, MO 65051

MEP ENGINEER: Toth & Associates
1550 E. Republic Road
Springfield, MO 65804

The Specifications to be authenticated by Toth & Associates and the undersigned seal is limited to the specification sections listed below. Toth & Associates hereby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by Toth & Associates.

Copyright **2021**; The specifications listed below are instruments of service and are property of Toth & Associates. This work is protected under U.S. Copyright Law and the Architectural Works Copyright Act of 1990. Failure to compensate Toth & Associates constitutes copyright infringement.

DIVISION 03 – CONCRETE
03 30 00 CAST IN PLACE CONCRETE

DIVISION 04 – MASONRY
04 20 00 UNIT MASONRY

DIVISION 05 – METALS
05 40 00 COLD FORMED METAL FRAMING



STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

MEP SPECIFICATION DISCLAIMER

PROJECT: State Technical College of Missouri – Utility Technician Center Phase B
OWNER: State Technical College of Missouri
LOCATION: One Technology Drive, Linn, MO 65051

MEP ENGINEER: IMEG Corporation
15 Sunnen Drive
Suite 104
St. Louis, MO 63143
Phone: 314.951.2518

The Specifications to be authenticated by IMEG and the undersigned seal is limited to the specification sections listed below. IMEG hereby disclaims any responsibility for all other specification sections relating to or intended to be used for any part of this project other than those prepared by IMEG.

Copyright **2021**; The specifications listed below are instruments of service and are property of IMEG. This work is protected under U.S. Copyright Law and the Architectural Works Copyright Act of 1990. Failure to compensate IMEG constitutes copyright infringement.

DIVISION 21 – FIRE SUPPRESSION

21 05 00 BASIC FIRE SUPPRESSION REQUIREMENTS
21 05 29 FIRE SUPPRESSION SUPPORTS AND ANCHORS
21 05 50 SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
21 05 53 FIRE SUPPRESSION IDENTIFICATION
21 13 00 FIRE PROTECTION SYSTEMS
21 30 00 FIRE PUMPS

DIVISION 22 – PLUMBING

22 05 00 BASIC PLUMBING REQUIREMENTS
22 05 13 MOTORS
22 05 16 PLUMBING EXPANSION COMPENSATION
22 05 29 PLUMBING SUPPORTS AND ANCHORS
22 05 48 PLUMBING VIBRATION ISOLATION
22 05 50 SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
22 05 53 PLUMBING IDENTIFICATION
22 07 16 PLUMBING EQUIPMENT INSULATION
22 07 19 PLUMBING PIPING INSULATION
22 09 00 INSTRUMENTATION
22 10 00 PLUMBING PIPING
22 10 30 PLUMBING SPECIALTIES
22 11 23 DOMESTIC WATER PUMPS
22 30 00 PLUMBING EQUIPMENT
22 40 00 PLUMBING FIXTURES

DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

23 05 00 BASIC HVAC REQUIREMENTS
23 05 13 MOTORS
23 05 48 HVAC VIBRATION ISOLATION



STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

23 05 50	SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
23 05 53	HVAC IDENTIFICATION
23 05 93	TESTING, ADJUSTING, AND BALANCING
23 07 13	DUCTWORK INSULATION
23 09 00	CONTROLS
23 09 13	INSTRUMENTATION
23 23 00	REFRIGERATION PIPING AND SPECIALTIES
23 31 30	DUCTWORK
23 33 00	DUCTWORK ACCESSORIES
23 34 23	POWER VENTILATORS
23 36 00	AIR TERMINAL UNITS
23 37 00	AIR INLETS AND OUTLETS
23 40 00	AIR CLEANING
23 73 13	INDOOR MODULAR AIR HANDLING UNITS
23 81 26	SPLIT SYSTEM AIR CONDITIONING UNITS
23 82 00	TERMINAL HEAT TRANSFER UNITS
23 82 16	AIR COILS

DIVISION 26 – ELECTRICAL

26 05 00	BASIC ELECTRICAL REQUIREMENTS
26 05 13	WIRE AND CABLE
26 05 26	GROUNDING AND BONDING
26 05 33	CONDUIT AND BOXES
26 05 48	SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS
26 05 53	ELECTRICAL IDENTIFICATION
26 05 73	POWER SYSTEM STUDY
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES
26 28 16	DISCONNECT SWITCHES
26 51 00	LIGHTING
26 52 00	EMERGENCY LIGHTING EQUIPMENT

DIVISION 27 – COMMUNICATIONS

27 05 00	BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS
27 05 26	COMMUNICATIONS BONDING
27 05 28	INTERIOR COMMUNICATION PATHWAYS
27 05 43	EXTERIOR COMMUNICATION PATHWAYS
27 05 53	IDENTIFICATION AND ADMINISTRATION
27 11 00	COMMUNICATION EQUIPMENT ROOMS
27 13 00	BACKBONE CABLING REQUIREMENTS
27 15 00	HORIZONTAL CABLING REQUIREMENTS
27 17 10	TESTING
27 17 20	SUPPORT AND WARRANTY

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 05 00	BASIC SAFETY AND SECURITY SYSTEMS REQUIREMENTS
28 13 00	ELECTRONIC ACCESS CONTROL
28 23 00	VIDEO SURVEILLANCE
28 31 00	FIRE ALARM AND DETECTION SYSTEM

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

SECTION 00 01 13 ADVERTISEMENT FOR BIDS

Notice is hereby given that sealed bids for **State Tech – Utility Technician Center Phase B #21-626** will be received at **State Tech Osage County Community Center Function Room** until **1:00pm** on **Thursday, June 24, 2021** and then publicly opened and read aloud. Each bid shall include **a five percent (5%)** bid security in the form of a certified check, cashier's check or bid bond executed by the bidder and an approved Surety Company.

The **State Tech – Utility Technician Center Phase B** project consists of an approximately 21,335 square foot addition to the existing Utility Technician Center building and related site work located on at the North end of the State Technical College of Missouri campus. The main areas of the building consists of Classroom and Lab spaces, including a dirt floor Lab used for boring and drilling. In addition, approximately 1,930 square feet of renovation is included to convert open Lab space to new Offices. The remaining space is allocated for mechanical, restroom, and storage areas.

Bidders may obtain Contract Documents on **Tuesday, May 25, 2021** from the following two sources:

American Document Solutions, 1400 Forum Blvd, Suite 7A, Columbia, MO 65203, (573) 446-7768. Documents may be viewed and ordered online at **adsplanroom.net**. Sets are available from ADS for a refundable deposit of \$100, check only, payable to American Document Solutions and mailing costs are the responsibility of the purchaser. Only documents returned within 10 days post bid in good condition will be refunded. A downloadable version of all Contract Documents is available for non refundable purchase.

County Blue Reprographics, 1449 Strassner Dr., St. Louis, MO 63144, (314) 961-3800. Documents may be viewed and ordered online at **countyblue.com**. Sets are available from County Blue for a refundable deposit of \$100 and mailing costs are the responsibility of the purchaser. A downloadable version of all Contract Documents is available for non refundable purchase.

For more information, please contact **Tracy Collins** at Paragon Architecture, (417) 885-0002, extension 1061.

The Owner reserves the right to award the contract to the lowest responsible bidder and to reject any and all bids and to waive any informality on all bids. No bid may be withdrawn for a period of **sixty (60) days**.

All bidders must provide a sworn affidavit affirming participation in a federal work authorization program and stating that the bidder does not knowingly employ any person who is not authorized to work in the U.S. **The contractor must comply with current Missouri Prevailing Wage laws and other statutory regulations as referred to in the specifications. This project is tax exempt.**

A Pre-Bid Conference will be held at **10:00am** on **Tuesday, June 8, 2021** at **State Tech Osage County Community Center Function Room**.

Substantial Completion: anticipate **Friday, April 15, 2022**.

00 21 13 INSTRUCTION TO BIDDERS

I. GENERAL:

- A. **AIA Document A701, "Instruction to Bidders–2018 Edition"** as published by the American Institute of Architects are hereby, except as may be inconsistent herewith, made part of these Bidding Documents. These **Instructions to Bidders** apply equally to and are part of all Bidding Documents between the Owner and each Contractor for Work under this Project.

II. SPECIAL NOTICE TO BIDDERS:

- A. These Specifications have bound hereto a complete set of bidding and contract forms. One complete signed set of bid forms as detailed in the Bid Forms Article shall be submitted in a sealed envelope plainly marked identifying the project and the bidder.

III. BID FORM

- A. The Bid Form shall be enclosed within a sealed envelope labeled **Bid Form** noting the **Project Title and time for bid opening**. Bid documents sent via mail shall be sealed within two envelopes (inner and outer), with the outer envelope addressed for the Project and marked "Sealed Bid Enclosed" on the face thereof, and with the inner envelope sealed and clearly labeled as described above.
- B. The OWNER may consider informal any bid not prepared and submitted in accordance with the provisions hereof. The OWNER reserves the right to waive minor technicalities and to reject any and all bids. Any bid received after the time and date specified shall not be considered.
- C. Each bid must be submitted on the **Bid Form** (Appendix A). All bids shall be submitted without modification or reservation on the bid form with each space properly filled. All blank spaces for bid prices must be filled in, in ink or typewritten, in both written and numeric, and the foregoing Certifications must be fully completed and executed when submitted.
- i. In the event of discrepancies within bidding documents, the written words will take precedence over the numeric presentation of the bid. If written words are absent from bid form, it will be considered an unresponsive bid.
- D. No contractor shall stipulate in their proposal any conditions not contained in the specifications or standard proposal form contained in the Contract Documents. Such submission may be a cause for rejection of bid.
- E. No telephonic, telegraphic, electronic mail, facsimile (FAX), or similar bid transmissions will be accepted or allowed. Copies of forms may be made but original signatures must be on the forms at the time of the submission on the bid proposal. Bidders must sign all forms and it is encouraged that a color other than black ink be used. Any modifications to bid shall be made as set forth within the Modifications and Withdrawals of Bids section.
- F. Bidders shall include the following bid forms at the time of bid submission. Failure to do so may result in rejection of bid.
- i. Signed Bid Form (Appendix A)
 - ii. Bid Guaranty
 - iii. Statement of Qualifications (Appendix A)
 - iv. Certificate of Affirmative Action
 - v. E-Verify

IV. INTERPRETATIONS AND ADDENDA

- A. No oral interpretations will be made to any bidder as to the meaning of the Contract Documents.
- B. Every request for interpretation shall be submitted in writing addressed and forwarded to **Tracy Collins at collins@paragon-architecture.com (417) 885-0002**.
- i. Submit requests a minimum of **7 business days** prior to date of receipt of Bids.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- ii. Anticipated release of Final Addenda: **5 business days** prior date of receipt of Bids.
- C. Every interpretation made to the bidder will be in the form of an addendum and will be sent through the plan room listed in the Notice to Bidders. All addenda shall become part of the Contract Documents.
- D. Any discrepancy, conflict, ambiguity, error or issue which may have more than one interpretation, should be forwarded to the Architect who may make the interpretation. In absence of an interpretation, issued by Addendum, the default position shall be for the bidder to bid the more restrictive and/or more costly interpretation which gives the Owner the option of either.

V. EXAMINATION OF DOCUMENTS AND AREA OF WORK

- A. Prior to bid, each bidder shall examine the Contract Documents carefully. Each bidder must carefully examine the entire limits of construction and surrounding area and shall make necessary investigations to be fully informed of the conditions relating to the construction of the Project and the employment of labor. Failure to do so will not relieve a successful bidder of the obligation to furnish all material and labor necessary to carry out the provisions of the contract. To the extent possible, the contractor, in carrying out the work, must employ such methods or means as will not cause any interruption or interference with the work of any other contractor.
- B. Contract Documents are not set up for specific trades and all Contractors and Subcontractors are required to review all drawings and specifications and must complete the work as shown on all portions of the contract documents. Each trade is required to review all portions of the Contract Documents including Drawings and Specifications.

VI. BID SECURITY

- A. Each bid must be accompanied by an original **Bid Guaranty** which shall be in the amount of **five (5%)** percent of the bid or bids submitted including all possible alternates, and at the option of the bidder may be a certified check, cashier's check or a bid bond issued by a qualified and approved bonding company.
- B. No bid will be considered unless it is so guaranteed and manually signed by both a principal of the construction corporation or company as well as the surety supplying the guaranty. Cash deposits, personal or company checks will not be accepted as a bid guaranty. 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 security will be realized upon or retained by the Owner.
- C. The bidder must submit a separate Bid Guaranty to cover each bid proposal submitted.
- D. Certified checks may be held uncollected at the bidder's risk. Certified checks of unsuccessful bidders will be returned as soon as a contract has been executed and an acceptable Performance and Payment Bond has been furnished.
- E. The Bid Guaranty submitted by the Bidder shall remain in force until such time as the Bidder is not awarded the contract, or if awarded, submits the required Performance and Payment Bond. Failure to submit the Performance and Payment Bond within the time specified or failure to accept award of the contract shall be deemed sufficient cause to forfeit the Bid Guaranty.
- F. 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 the Owner for any damages sustained because of failure to execute and deliver the required contract and performance bond.

VII. STATEMENT OF QUALIFICATIONS

- A. Each bid must be accompanied by a **Statement of Qualification** using the form furnished in Appendix A.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as may be requested. The Owner reserves the right to reject any bids where the investigation or consideration of the information submitted by such bidder does not satisfy the Owner that the bidder is qualified to carry out properly the terms of the Contract Documents.
- C. All professional service contracts and construction contracts arising from this work must use firms/businesses that are licensed to operate in the jurisdiction where the Project is located. No funds will be released to pay businesses that do not hold this license. All businesses involved with this project must be licensed and in good standing with the **[Missouri]** Secretary of State's Office.

VIII. ALLOWANCES

- A. Allowances shall be contained in the Contractor's original proposal and incorporated into the contract. Allowances contained in the contract's original proposal are understood to include the Contractor's overhead and profit and are valid thru the duration of the contract.
- B. Please refer to **Section 01 21 00 Allowances** for more information.

IX. UNIT PRICES

- A. Unit prices shall be contained in the Contractor's original proposal and incorporated into the contract. Unit prices contained in the contract's original proposal are understood to include the Contractor's overhead and profit and are valid thru the duration of the contract.
- B. Please refer to **Section 01 27 00 Unit Prices** for more information.

X. ALTERNATIVE BIDS

- A. No alternative bids will be considered.

XI. APPROVE EQUAL AND SUBSTITUTION POLICY

- A. Any request for substitutions by the Contractor, or on behalf of any subcontractor or material supplier, shall be submitted to the Architect at least ten days prior to the date for receipt of Bids on the attached **Request for Substitution** form in Appendix B. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. No substitutions will be considered after the contract award unless specifically provided in the Contract Documents.
- B. Please refer to **Section 01 25 00 Substitution Procedures** for more information.
- C. Within the product specification sections, the intent of the manufacturer's list is to provide a "basis of design" (a standard level of quality) and not solely restricted to those providers.

XII. TIME FOR RECEIVING BIDS

- A. The time and location for receiving bids shall be as noted in the **Section 00 01 13 Advertisement for Bids**.
- B. Bid received prior to the time of the opening will be securely kept, unopened. The office whose duty it is to receive bids will decide when the specified time has arrived, and no bid received thereafter will be considered. No responsibility will attach to any office for the premature opening of a bid not properly addressed and identified.
- C. Bidders are cautioned to allow ample time for transmittal of bids by mail or otherwise. If a bid is mailed, bidders should secure correct information relative to the probable time of arrival and distributions of mail at the place where bids are to be received, and make due allowance for possible delays.
- D. Bidder's attention is directed to the fact that no bid will be accepted or considered if submitted after the specified time for receiving bids.

XIII. MODIFICATIONS AND WITHDRAWAL OF BIDS

- A. Modification or correction of previously submitted bids may only be submitted by letter or in-person prior to the scheduled time for the receipt of bids. Modifications or corrections must be clearly marked with bid date, project title, and received by the Owner prior to the scheduled closing time for the receipt of bids in accordance with following provisions:
 - i. To maintain bid confidentiality and ensure assignment to the proper bid, any such written request must be contained in a sealed envelope that is plainly marked "Modification of Bid on (Project Title and bid date)".
 - ii. All modifications to bids shall be provided from a verifiable source of those submitting the bid.
 - iii. A bidder may withdraw their bid at any time prior to the scheduled closing time for the receipt of bids or authorized postponement thereof, but no bidder may withdraw their bid for the period stated within the Bid Proposal after closing time for the receipt of bids. Request to withdraw bid must be made in-person or by written request.
 - iv. No bidder may withdraw their bid for a period of **[thirty (30)]** calendar days after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

XIV. AWARD OF CONTRACT

- A. It is reasonably expected that a contract will be awarded and signed with **seven (7)** days of bid opening, but no later than **thirty (30)** days, and that the Work shall commence as indicated in the contract (Appendix B).
- B. It is the intent of the Owner to award a contract to the lowest responsive qualified bidder complying with the conditions of the Contract Documents providing that the bid is reasonable and it is in the interest of the Owner to accept the same. The bidder to whom an award is made will be notified at the earliest possible date.
 - i. Selection of the lowest bidder will be as follows: award of contract will be to the lowest base project bid. If funds allow, the award will move to the lowest base project bid plus project alternate.
 - ii. The Owner, however, reserves the right to reject any and all bids and to waive any or all informalities in bids received whenever such rejection or waiver is in the interest of the Owner.
- C. The Contract Sum will be determined by the sum of the base bid, and/or the sum of any or all bid alternates, in any order, which the Owner may choose to add or delete from the base bid.
- D. The successful bidder shall execute the contract with the Owner in the form of the draft contract included within Appendix B.

XV. CONTRACT PERFORMANCE AND PAYMENT BOND

- A. The bonds in an amount at least equal to 100% of the total amount of the contract guaranteeing the full and prompt completion of the work and performance of the contract and for the payment of all labor and material and be made payable to OWNER.
 - i. The bidder shall deliver the required bonds to the Owner not later than **3 days** following the date of execution of the Contract.

XVI. CONSTRUCTION TIME AND LIQUIDATED DAMAGES

- A. The contract requires work to be Substantially Completed no later than the date shown on the **Section 00 01 13 Advertisement for Bids**.
- B. The Owner requires the Contractor to coordinate all work and cooperate with the Owner regarding partial occupancy for purpose of installing furniture and equipment, and prepping of floors and spaces for full occupancy.
- C. Liquidated Damages: refer to contract draft, section 4.5.

XVII. SUBCONTRACTS

- A. The Bidder is specifically advised that any person, for, or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner.
- B. See Bid Form for Subcontractor List that must be submitted with bid.
- C. The Contractor shall list all subcontractors performing the work listed on the Subcontractor List regardless of the amount of work performed.
- D. If the General Contractor plans to use its own forces for any portion of the work noted in the categories, then the General Contractor must list itself. Failure to list a subcontractor or the General Contractor may result in a rejection of bid as non-responsive.

XVIII. PERMITS, FEES, SPECIAL INSPECTIONS, TAX EXEMPTION and WAGE RATES

- A. The Contractor is responsible for the building permit and plan review fees, trade permits, tap fees and temporary utility installation, and inspections required of the AHJ; these fees shall be included in the contract and paid by the Contractor.
- B. The Owner is responsible for utility service charges, special inspections and third party material testing. The Owner shall bear the costs of test, inspections, or approvals that arise as the result of a change in laws or regulations that do not become effective and that the parties are not aware of until after bids are received or negotiations concluded.
- C. The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the contract throughout, and they will be deemed to be included within the contract the same as though herein written out in full. These include State of Missouri RSMo 285.530, (1) No business entity or employer shall knowingly employ, hire for employment, or continue to employ unauthorized alien to perform work within the State of Missouri.
- D. The Owner will exercise their tax-exempt status and require that the bid amount NOT include sales tax on materials. Any materials the Contractor wishes to exempt sales tax may be purchased by the Contractor/Subcontractor by authorization from the Owner via a Project Exemption Certification, which is provided within Appendix B.
- E. Bidder must agree to comply with **Prevailing Wage Rate provisions per the Missouri Department of Labor Standards** for all labor utilized on this project. Any of the applicable Annual Wage Orders are included in these specifications. (Appendix B).

XIX. MATERIALS AVAILABILITY

- A. Prior to bidding, the Contractor shall confirm that all major materials, suppliers and subcontractors, which may impact the critical path of the Construction Schedule, are able to be delivered and/or provided such that the project schedule and substantial completion date are not adversely affected. The Contractor shall immediately notify the Architect of any such conflicts and adversities, prior to issuance of the final addendum, prior to bidding.
- B. The Contractor bears sole and full responsibility for compliance with terms of the contract for time and completion.

XX. SAFETY STANDARDS AND ACCIDENT PREVENTION

- A. With respect to all work performed under this contract, the contractor shall comply with safety standards, provisions, applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the standard OSHA regulations and any other Federal, State or municipal regulations.
 - i. All on-site employees of the Contractor and subcontractors are required to complete the ten hour OSHA training program.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. All workers on the Project will be expected to dress neatly wearing shirts with sleeves, bearing the logo of the employing company. Hard hats will be worn at all times. Tobacco products and other controlled substances are not permitted on the property.

XXI. INSURANCE REQUIREMENTS

- A. Please refer to **Exhibit A: Insurance and Bonds** within Appendix B.

XXII. ADVERSE WEATHER CONDITIONS

- A. The Contractor shall use historical monthly averages for the NOAA location closest to the project site as the basis for establishing a "Weather Calendar" showing the number of anticipated non-working days for each month due to adverse weather, Saturdays, Sundays and all Federal Holidays as non-work days. The Owner will issue a modification in accordance with the contract clauses, giving the contract a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay day exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities critical to contract completion. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

SECTION 00 26 00 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

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

1.3 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
 - 1. Extensive revisions to the Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 - 3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:
 - 1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
 - 2. Submittal Format: Submit one digital copy of each written Procurement Substitution Request, using CSI Substitution Request (during bidding) Form 1.5C (**Appendix B**).
- B. Architect's Action:
 - 1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 002600

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work under separate contracts.
 - 4. Access to site.
 - 5. Coordination with occupants.
 - 6. Work restrictions.
 - 7. Specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

- A. Project Identification: **State Tech – Utility Technician Center Phase B #21-626**
 - 1. Project Location: One Technology Lane, Linn, MO.
- B. Owner: **Regents of State Technical College of Missouri**
 - 1. Owner's Representative: **Dr. Shawn Strong**
- C. Architect: **Paragon Architecture, LLC.**
 - 1. Architect's Representative: **Tracy Collins**
- D. Web-Based Project Software: Project software administered by Architect will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 013100 "Project Management and Coordination." for requirements for administering and using web-based Project software.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Approximately 21,335 square foot addition to the existing Utility Technician Center building and related site work located on at the North end of the State Technical College of Missouri campus. The main areas of the building consists of Classroom and Lab spaces, including a dirt floor Lab used for boring and drilling. Approximately 1,930 square feet of renovation is included to convert open Lab space to new Offices. The remaining space is allocated for mechanical, restroom, and storage areas.
- B. Type of Contract.
 - 1. Project will be constructed under a single prime contract.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1.4 WORK UNDER SEPARATE CONTRACTS

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

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. All access to project site must come through front drive at entrance of Campus.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather-tight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Available working hours of **6:00 a.m. to 6:00 p.m., Monday through Friday**, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Non-smoking Building: Smoking is not permitted on any State Tech property.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 21 00 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Quantity allowances.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
 - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.
 - 3. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
 - 4. Divisions 2 through 16 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, notify Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM, UNIT-COST, AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. **Allowance No. 1:** Quantity Allowance: Include **1500 cy** of unsatisfactory soil excavation and disposal off-site (Item "a" in Schedule of Unit Prices) and replacement with satisfactory soil material from off-site (Item "f" in Schedule of Unit Prices)—as specified in Division 31 Section "Excavation & Fill" and the Geotechnical Engineering Report.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Coordinate quantity allowance adjustment with unit price requirements of Division 01 Section "Unit Prices".
2. All quantities shall be verified and any adjustments (either adds or deducts) are subject to approval by the Architect.
3. If actual conditions require less than the allowance listed above of unsatisfactory soil excavation, a change order will be issued to deduct the remaining balance from the Contract. Costs will be based on Unit Prices identified in Section 012200 and submitted on the bid form.
4. The contractor shall provide a 2'-0" Low Volume Change layer under all slabs on grade, per structural drawings, as part of the base bid. This allowance is for any unsuitable soils outside of the Low Volume Change layer.

B. **Allowance No. 2:** Quantity Allowance: Include **10 cy** of rock excavation (for footings and all trenches) and disposal off-site (Item "i.2" in Schedule of Unit Prices) and replacement with satisfactory soil material from off-site (Item "f" in Schedule of Unit Prices) as specified in Division 31 Section "Excavation & Fill" and the Geotechnical Engineering Report.

1. Coordinate quantity allowance adjustment with unit price requirements of Division 01 Section "Unit Prices".
2. All quantities shall be verified and any adjustments (either adds or deducts) are subject to approval by the Architect.
3. If actual conditions require less than the allowance listed above of unsatisfactory soil excavation, a change order will be issued to deduct the remaining balance from the Contract. Costs will be based on Unit Prices identified in Section 012200 and submitted on the bid form.

END OF SECTION 012100

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

- A. Substitution Requests (After Bidding): Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A. See **Appendix B**.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Contractor's construction schedule.
 - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - d. Requested substitution is compatible with other portions of the Work.
 - e. Requested substitution has been coordinated with other portions of the Work.
 - f. Requested substitution provides specified warranty.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architects standard form.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. The combined maximum allowable Overhead and Profit margins (from both General Contractor and Sub-Contractor separately) for any change order shall not exceed ten percent (10%). Bond & Insurance combined charges shall not exceed two percent (2%). Total Overhead, Profit, Bonds and Insurance shall not exceed twelve percent (12%).
 - e. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - f. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. The combined maximum allowable Overhead and Profit margins (from both General Contractor and Sub-Contractor separately) for any change order shall not exceed ten percent (10%). Bond & Insurance combined charges shall not exceed two percent (2%). Total Overhead, Profit, Bonds and Insurance shall not exceed twelve percent (12%).
6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
7. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
8. Work Change Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Contractor will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 27 00 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. See Division 1 Section "Allowances" for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

- A. Schedule of Unit Prices as shown in **Bid Proposal Form in Appendix A.**
 - 1. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 01270

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 012700 "Unit Prices" for administrative requirements governing the use of unit prices.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect through Construction Manager at earliest possible date but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the **last** day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- C. Application for Payment Forms: Use AIA Document G702/CMA and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit Digital signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Schedule of unit prices.
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707-1994, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project Web site.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

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

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
 - 2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT WEB SITE

A. Use Architect's Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:

1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.
9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.
12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.

B. On completion of Project, Architect will provide one complete archive copy(ies) of Project Web site files to Owner and to Contractor in a digital storage format.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-Installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings for duration of construction period at bi-weekly intervals.
- 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

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

1.4 ELECTRONIC SUBMITTAL SERVICE

- A. Electronic Submittals – General: Shop drawings and product data submittals shall be transmitted to Architect & Design Team in electronic (PDF) format using Submittal Exchange (www.submittalexchange.com), a website service designed specifically for transmitting submittals between construction team members.
 - 1. Cost of Submittal Exchange service is provided by Architect.
 - 2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
 - 3. The electronic submittal process is not intended for color samples, color charts, or physical material samples; submittals of this type shall be transmitted to the Architect in hard copy as outlined below.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. At Contractor's option, FREE training is available from Submittal Exchange regarding use of website, website's services, and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
5. Electronic Submittals: Internet Service and Equipment Requirements:
 - a. Email address and Internet access at Contractor's main office and construction website.
 - b. Software shall be used to apply electronic stamps, markup, or comments. Acceptable software includes, but is not limited to the following:
 - 1) Adobe Acrobat (www.adobe.com).
 - 2) Bluebeam PDF Revu (www.bluebeam.com).
 - 3) PDF X-Change (www.tracker-software.com).

1.5 ELECTRONIC SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Electronic Submittal Service: The successful Contractor shall be required to utilize the electronic submittal service "Submittal Exchange" (www.submittalexchange.com) to communicate construction documents between project team members throughout the entirety of the Project.
 1. The successful Contractor will be required to use Submittal Exchange as an Administrative User.
 - a. Bidders should contact Tanner Steinhoff, a Submittal Exchange representative, at 813.636.7634 for more information at the time of bidding and to discuss the functions of Submittal Exchange.
 2. Subcontractors and Suppliers who are involved with the Project will also be required to utilize Submittal Exchange.
 - a. Bidders should contact Tanner Steinhoff, a Submittal Exchange representative, at 813.636.7634 for more information at the time of bidding and to discuss the functions of Submittal Exchange.
 3. Unless indicated otherwise, all construction submittals required by the Contract Documents, including but not limited to Shop Drawings, Product Data, and Warranties, shall be provided in electronic Portable Document Format (PDF) and shall be transmitted via the electronic service "Submittal Exchange."
 4. Project Documents and Correspondence required to be hosted on Submittal Exchange:
 - a. Project team directory.
 - b. Project submittals and logs.
 - c. Addenda.
 - d. Logs:
 - 1) RFI log.
 - 2) Supplemental log.
 - 3) Proposal Request log.
 - 4) Change Order log.
 - e. Payment application forms.
 - f. Full size sheet revisions.
 - g. Meeting agenda and minutes.
 - h. Schedule and calendar management.
 - i. Testing Reports.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- j. Field Reports.
 - k. Progress Photo documentation.
 - l. Closeout Documents.
 - m. Online document collaboration.
 - n. Reminder and tracking functions.
 - o. Archiving functions.
- B. All documents transmitted for the purposes of administration of the contract are to be in electronic (PDF) format and transmitted via Submittal Exchange, an Internet-based collaboration system for communicating documents between project team members.
 - 1. Contractor's Responsibility: Provide all documents in PDF format.
 - 2. Architect reserves the right to reject and not review documents in other formats including but not limited to Paper Document transmittals and Emailed Document transmittals.
 - 3. All other specified submittals and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining Archive copies of files for Owner.

1.6 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
 - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Paragon Architecture's "Exhibit D: Digital Data Transmittal Agreement."
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use Specification Section number followed by a dash and then a sequential number (e.g., 061000-001). Resubmittals shall include an alphabetic suffix (e.g., LNHS-061000-001A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
 - a. Submittal Preparation:
 - 1) Contractor, Subcontractors and Suppliers originating submittal documents are required to utilize Submittal Exchange.
 - 2) Submittal Exchange (www.submittalexchange.com), 1-800-714-0024
 - b. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer and/or product, dimensions and coordination of information with other parts of the Work.
 - c. Contractor shall transmit each submittal to Architect using the Submittal Exchange website (www.submittalexchange.com).
2. Architect and/or Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notifications of completed review.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Pre-Construction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - d. When testing is complete, remove test specimens, assemblies, and mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- C. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. Do not perform any duties of Contractor.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections on Structural Drawings, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
 - 1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 - 2. ICC - International Code Council; www.iccsafe.org.
 - 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch0.148-inchthick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inchOD corner and pull posts, with 1-5/8-inchOD top and bottom rails. Provide galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system private system indicated as directed by authorities having jurisdiction.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Remove snow and ice as required to minimize accumulations.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touchup signs so they are legible at all times.
 - F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
 - G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - A. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
 - B. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
 - C. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Insulate partitions to control noise transmission to occupied areas.
 - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. Protect air-handling equipment.
 7. Provide walk-off mats at each entrance through temporary partition.
- D. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents, will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in a reduction of their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- B. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect Construction Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements, including touchup painting.
 - 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report and warranty.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. By Architect.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- h. Sweep concrete floors broom clean in unoccupied spaces.
- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
- k. Remove labels that are not permanent.
- l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- p. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

END OF SECTION 017823

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
 - 1) Submit record digital data files and one set(s) of plots.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. made.
 3. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on electronic website.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Pre-Construction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

END OF SECTION 017900

SECTION 02 41 00 – DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- D. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

PART 3 EXECUTION

2.1 SCOPE

- A. Remove portions of existing building as noted in Contract Document Demolition Plans.
- B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

2.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 2. Provide, erect, and maintain temporary barriers and security devices.
 - 3. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 4. Do not close or obstruct roadways or sidewalks without permit.
 - 5. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 6. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.

2.3 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and others): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

2.5 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 00

SECTION 024113 - SITE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: removal of existing buildings, equipment pads, foundations, paving, curb and gutter, underground tanks, pipes and utilities, fences, and other site items as required by the project drawings.

1.2 SUBMITTALS

- A. Obtain necessary permits required for demolition and submit copies to the Owner before beginning site demolition work.

1.3 PROTECTION

- A. Protection of Existing Work: Before beginning cutting or other site demolition work, carefully survey the existing work and examine the project drawings and specifications to determine the extent of the work. Take necessary precautions to ensure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner. Repair or replace damage to work at no additional cost to the Owner. Carefully coordinate the work of this section with other work and construct and maintain shoring, bracing and supports, as required. Ensure that structural elements are not overloaded. Increase structural support or add new supports, as required as a result of cutting, removal, or demolition of work performed.
- B. Benchmarks, Property Markers, and Iron Pins: The Contractor shall maintain all benchmarks, monuments, property markers, iron pins and other reference points during site clearing operations. In the event that any of the above mentioned are disturbed or destroyed during any construction activities the Contractor shall replace them, as directed by the Owner, at the Contractor's expense.
- C. Existing Utilities:
 - 1. Follow rules and regulations of the authorities having jurisdiction for the respective utilities in execution of the work under this section.
 - 2. Active Utilities Shown on Project Drawings: Protect from damage and remove or relocate only as indicated or specified. Take special precautions not to damage utility lines, manholes, or other structures. Correct any damage to utilities or structures to original or better condition at no additional cost to the Owner.
 - 3. Active Utilities Not Shown on Project Drawings: When any functioning underground utilities are uncovered during the work which are not shown on the project drawings, promptly notify the Owner in writing. Protect or relocate in accordance with written instructions of the Owner. The Contractor shall exercise caution during all phases of the work, as all utilities may not be shown on the Project Drawings. A utilities' omission from the Project Drawings will not relieve the Contractor of their responsibility to correct any damage to said utility at no additional cost to the Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY CENTER – PHASE B

4. Inactive and Abandoned Utilities: Remove, plug, or cap in the absence of specific requirements. Plug or cap utility lines at least five feet outside of new building walls or as required by local regulations.
- D. Adjacent Properties: Protect adjacent properties during site demolition operations. Site demolition shall be limited to Owner's property. The Contractor shall also protect existing structures on adjacent properties; including by not limited to fences, utility lines, manholes, catch basins, valve boxes, poles, guys and other appurtenances. Damage done to structures on adjacent properties shall be the Contractor's responsibility to repair, at no additional cost to the Owner.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 DEMOLITION

- A. Structures: Demolish existing structures by breaking these materials into smaller pieces for transport. The use of explosives is not permitted.
- B. Utilities: Remove or abandon in place existing utilities as indicated on the project drawings. Disconnect utility services, with related meters and equipment, employing appropriate utility company. When utility lines are encountered that are not indicated on the project drawing, notify the Owner.
- C. Sidewalks, driveways, curb and gutter, drainage structures and similar obstructions permitted to be removed shall be cut in straight lines or removed to the nearest construction joint if located within five feet of the edge of the excavation. In no case shall the joint or line of cut be less than one foot outside the edge of excavation.

3.2 RELOCATION AND RETURN OF MATERIAL OR EQUIPMENT

- A. Carefully dismantle, in manner to avoid damage, all materials and equipment specified or indicated to be relocated or returned to the Owner.
- B. Store materials and equipment to be reused in a manner to avoid corrosion, staining, breakage, or damage.
- C. Material or equipment specified or indicated to be relocated or returned to the Owner and damage due to Contractor's negligence shall be repaired or replaced as directed by Owner.

3.3 DISPOSITION OF MATERIALS

- A. Dispose of demolished materials off of the project site unless otherwise notified by the Owner. Transport materials in a manner that will prevent spillage on streets and adjacent areas. Dispose of materials in a manner acceptable to the regulatory agency having jurisdiction.

3.4 PROTECTION OF EXISTING TREES

- A. Protect trees to remain in the manner described in Section 31 10 00 Site Clearing.
- B. Provide tree protection measures prior to beginning of demolition and maintain throughout the work period.

3.5 BACKFILLING AND COMPACTION

- A. Backfill holes and depressions resulting from site demolition in the manner described in Section 31 23 00 Excavation and Fill.

END OF SECTION 024113

SECTION 03 05 16 - UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

1.2 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers' data on manufactured products.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum as tested per ASTM E1745.
 - 2. Thickness: 15 mils minimum.
 - 3. Strength: ASTM E1745, Class A.
 - 4. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fortifiber Building Systems Group; Moistop 15.
 - b. Grace Construction Products, W.R. Grace & Co.; Perminator 15 mil.
 - c. Grace Construction Products, W.R. Grace & Co.; Florprufe 120.
 - 1)
 - d. Stego Industries LLC; Stego Wrap Vapor Barrier 15 mil
 - e. Substitutions: See Section 00 00 00 - Substitution Procedures.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove all construction debris, limbs, leaves, and other organic materials from the surface over which the vapor barrier is to be installed.

3.2 EXAMINATION

- A. Verify that surface over which the vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.3 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION 03 05 16

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- E. Samples: For vapor retarder
- F. Welding certificates.
- G. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Semirigid joint filler.
 - 12. Joint-filler strips.
 - 13. Repair materials.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- J. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- 2.2 STEEL REINFORCEMENT
- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
 - B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
 - C. Plain-Steel Wire: ASTM A 82, as drawn.
 - D. Deformed-Steel Wire: ASTM A 496.
 - E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
 - F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- 2.3 REINFORCEMENT ACCESSORIES
- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
 - B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- 2.4 CONCRETE MATERIALS
- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type I/II, gray, with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Fly Ash: Class C flyash is also acceptable.
 - B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - C. Water: ASTM C 94 and potable.
- 2.5 ADMIXTURES
- A. Air-Entraining Admixture: ASTM C 260.
 - B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Raven Industries Inc.; Vapor Block 15.
 - b. Reef Industries, Inc.; Griffolyn 15 mil Green.
 - c. Stego Industries, LLC; Stego Wrap 15 mil Class A.
 - d. Other products are subject to Architect/Engineer Approval.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ChemMasters; Chemisil Plus.
 - b. ChemTec Int'l; ChemTec One.
 - c. Conspec by Dayton Superior; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - f. Edoco by Dayton Superior; Titan Hard.
 - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; LIQUI-HARD.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group; Duro-Nox.
 - m. Symons by Dayton Superior; Buff Hard.
 - n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
 - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Note: use of curing compounds will not be allowed at slabs that are indicated to receive flooring – concrete slabs receiving flooring shall be wet cured.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATExOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfil 420.
 - i. Lambert Corporation; AQUA KURE - CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - l. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.
 - n. SpecChem, LLC; Spec Rez Clear.
 - o. Symons by Dayton Superior; Resi-Chem Clear.
 - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- 2.10 RELATED MATERIALS
- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
 - C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
 - D. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
 - E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- 2.11 REPAIR MATERIALS
- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.
 - B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.
- 2.12 CONCRETE MIXTURES, GENERAL
- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash: 25 percent.
 - C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
 - D. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use high-range water-reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- 2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS
- A. Footings, Foundation Walls, Interior Slabs on Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: Refer to drawings.
 2. Maximum Water-Cementitious Materials Ratio: Refer to drawings.
 3. Slump Limit: Refer to drawings.
 4. Air Content: 6 percent, plus or minus 1 percent at point of delivery for concrete exposed to freezing.
 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 - B. Exterior Uses, Stairs, Slabs-on-Grade etc: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1 percent at point of delivery.
- 2.14 FABRICATING REINFORCEMENT
- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- 2.15 CONCRETE MIXING
- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.
- 3.4 VAPOR RETARDERS
- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 2. Tape around all penetrations & Lap edges up over top of foundation wall a min of 4"
- 3.5 STEEL REINFORCEMENT
- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
 - B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
 - C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
 - E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- 3.6 JOINTS
- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 - E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances according to ASTM E 1155, for a randomly trafficked floor surface: Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35.
 3. Finish surfaces criteria listed in this section shall be considered the minimum acceptable level for F(F) and F(L). Review requirements for all project required flooring for criteria that may be more stringent than this sections. All flooring manufacturers' requirements shall be met where the flooring is to be utilized.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 03 35 11 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Polishing concrete floors.

1.02 REFERENCE STANDARDS

- A. American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Appearance Chart, PCAC-11.17.
- B. ASTM D5767 - Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces.
- C. ASTM D4039 - Standard Test Method for Reflection Haze of High-Gloss Surfaces.
- D. American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Aggregate Exposure Chart, PCAEC - 11.17.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 PRE-INSTALLATION MEETING

- A. Conduct pre-installation conference at Project Site at least one week ahead of installation.
 - 1. Discuss each step of grinding, honing, and polishing operations.
 - 2. Discussed the application of liquid applied products.
 - 3. Discuss protection of polished concrete floors before and after installation.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- B. Installer's Qualification Data: Provide written Installer's Certification documentation from the manufacturer confirming that installer meets the qualifications as specified.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.07 QUALITY ASSURANCE

- A. Use an experienced, manufacturer approved, manufacturer certified installer, and adequate number of skilled workers who are trained and experienced in the work being performed.
- B. The installer will perform all work in accordance with the Concrete Polishing Council recommendations and will adhere to their standards as well as those specified herein.
- C. Protection
 - 1. All hydraulic powered equipment must be diapered and utilize tire bags.
 - 2. Pipe fitting and threading activities shall occur in location other than on concrete slabs to be polished.

3. Acids and acidic detergents must not come into contact with the slab.

1.08 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet (3 m) square.
- C. Locate where directed by Architect.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials in original containers, bearing manufacturer's labels indicating brand name, product name, numbering, and directions for storage. Materials shall remain sealed until installation activities start.
- B. Store all materials and products per manufacturer requirements and recommendations.
- C. Handle all materials and products per manufacturer requirements and recommendations.

1.10 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of {CH#163387} minimum during installation.
- D. Test concrete for alkalinity. Do not perform system installation until acceptable alkalinity range is met and can be maintained during installation.
 1. Test Method: ASTM F710.
 2. Acceptable Range: 8 to 13.
- E. Test concrete for vapor transmission rate. Do not perform system installation until acceptable conditions are met and can be maintained during installation.
 1. Test Method: ASTM F1869.
 2. Acceptable Conditions: No more than 5 pounds per 1,000 square feet in 24 hours.
- F. Test for relative humidity. Do not perform system installation unless acceptable conditions are met and can be maintained during installation.
 1. Test Method: ASTM F2170.
 2. Acceptable Conditions: No more than 75 percent.

PART 2 PRODUCTS

2.01 POLISHED CONCRETE SYSTEM

- A. Polished Concrete System: Provide materials, products, equipment, and procedures designed and furnished by a single manufacturer to chemically treat concrete to create and maintain a clear, dense, abrasion and chemical resistant, durable, and hard surface.
 1. Basis of Design Product: Subject to compliance with requirements, provide PROSOCO, Inc., Consolideck Polished Concrete System or comparable product by one of the following:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Euclid Chemical Company
 - b. W. R. Meadows, Inc
 - c. Advanced Floor Products
 - d. MAPEI Corporation
 - e. Vexcon Chemicals, Inc.
 - f. Diamond Shield.
- B. Appearance: Provide Polished Concrete Appearance as indicated on Drawings with reference to American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Appearance Chart, PCAC-11.17.
- C. Aggregate Exposer: Expose aggregate with polishing installation as indicated on Drawings with reference to American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Aggregate Exposure Chart, PCAEC-11.17.
- D. Pre-Densifier Floor Cleaner: Provide as required and recommended by densifier manufacturer.
- 2.02 ACCESSORIES
- A. Repair Material: Provide a product for the repair of cracks and surface imperfections. Provide bonding materials that have sufficient bonding strength to adhere after polishing process as well as abrasion resistance equal to or greater than the substrate.
- B. Grout Material: Provide a thin mortar used for filling voids. Use manufacturer recommended product following manufacturer recommendations for installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section. Document all unacceptable conditions in writing and distribute to the general contractor.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
- C. Verify that concrete floor flatness rating is at least 40. Notify the contractor if floor flatness rating falls below 40. Do not proceed with installation until concrete floor flatness rating is at least 40.
- D. Verify that floor levelness rating is at least 30. Notify the contractor if floor levelness rating is less than 30. Do not proceed with installation until concrete floor levelness rating is at least 30.
- E. Verify that concrete has cured a minimum of 28 days. Do not proceed with installation until concrete has cured a minimum of 28 days.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions, requirements, and recommendations. This includes substrate temperature, moisture content, ambient temperature, humidity, ventilation and all other conditions affecting the process identified by the manufacturer.
- B. Application shall take place at least 10 days prior to the placement of furniture, fixtures, and equipment on area of work. Contractor shall not place furniture, fixtures, or equipment on the area of work until at least 10 days beyond installation.

- C. Coordinate system installation with joint filling operations. Joint filling shall not occur within 72 hours of wet cleaning without manufacturer's written approval. If manufacturer's approval of wet cleaning within 72 hours is secured provide the manufacturer's written approval to Contractor and Architect before commencing wet cleaning activities.
- D. If sweeping compounds are to be used, use non-oil based sweeping compounds.

3.03 PREPARATION

- A. Close all areas of concrete polishing activities to traffic during and after application for at least the minimum time period required by the manufacturer. Remove all equipment and materials from the installation area.
- B. Correct all unacceptable conditions prior to the installation of system. Commencement of work constitutes acceptance of substrate conditions by the installer.
- C. Clean floors per manufacturer requirements and recommendations prior to system installation.
- D. Treat oil spots with oil remediation systems following manufacturer requirements and recommendations.
- E. Scrub the floor with a scrubber machine and appropriate brushes and pads and pH compatible detergent. Follow all manufacturer requirements and recommendations for scrubbing.

3.04 COATING APPLICATION

- A. A technically qualified densifier manufacturer's field representative must be present at the initial application of the densifier and stain protector with occasional observations of subsequent applications. The representative shall ensure that the correct amount of densifier and stain protector are onsite and in numbered containers prior to the commencement of the work. The densifier manufacturer's field representative must provide written documentation of observations to Contractor and Architect.
- B. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- C. Verify that alkalinity, water vapor emission from concrete, and relative humidity of concrete are within limits established by coating manufacturer.
- D. Protect adjacent non-coated areas from drips, overflow, and overspray. Immediately remove excess material if it occurs.
- E. Apply coatings in accordance with manufacturer's instructions. Apply coatings matching the mock-up's color, special effects, sealing, and workmanship.

3.05 CLEANING AND PROTECTION

- A. Clean the finished surface as required and recommended by manufacturer.
- B. Protect the finished surface from construction traffic and equipment after installation.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU's).

B. Related Sections:

1. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
2. Section 076200 "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: **Contractor** will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- C. Samples for Verification: For each type and color of exposed masonry unit and colored mortar.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties and material test reports substantiating compliance with requirements.

- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for typical exterior wall typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.

1.6 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Integral Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ACM Chemistries; RainBloc.
- b. BASF Aktiengesellschaft; Rheopel Plus.
- c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

- C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight below grade; Normal or Lightweight above grade, unless otherwise indicated.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

- D. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Capital Materials Corporation; Flamingo Color Masonry Cement.
- b. Cemex S.A.B. de C.V.; Brikset Type N.
- c. Essroc, Italcementi Group; Brixment.
- d. Holcim (US) Inc.; Mortamix Masonry Cement.
- e. Lafarge North America Inc.; Magnolia Masonry Cement.
- f. Lehigh Cement Company; Lehigh Masonry Cement.
- g. National Cement Company, Inc.; Coosa Masonry Cement.

- E. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
- 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
- 3) Lafarge North America Inc.; Eaglebond Portland & Lime.

- 4) [Lehigh Cement Company](#); Lehigh Custom Color Portland/Lime Cement.

F. Aggregate for Mortar: ASTM C 144.

1. For joints less than **1/4 inch** thick, use aggregate graded with 100 percent passing the **No. 16** sieve.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. [Products](#): Subject to compliance with requirements, provide one of the following:

- a. [Euclid Chemical Company \(The\)](#); Accelguard 80.
- b. [Grace Construction Products, W. R. Grace & Co. - Conn.](#); Morset.
- c. [Sonneborn Products, BASF Aktiengesellschaft](#); Trimix-NCA.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.

1. [Products](#): Subject to compliance with requirements, provide one of the following:

- a. [ACM Chemistries](#); RainBloc for Mortar.
- b. [BASF Aktiengesellschaft](#); Rheopel Mortar Admixture.
- c. [Grace Construction Products, W. R. Grace & Co. - Conn.](#); Dry-Block Mortar Admixture.

J. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, **Grade 60**.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: **0.148-inch** diameter.
4. Wire Size for Cross Rods: **0.148-inch** diameter.
5. Wire Size for Veneer Ties: **0.148-inch** diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than **16 inches** o.c.
7. Provide in lengths of not less than **10 feet**, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single **0.187-inch-** diameter, hot-dip galvanized, carbon or stainless-steel continuous wire.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a **100-lbf** load in both tension and compression without deforming or developing play in excess of **0.05 inch**.
2. Fabricate sheet metal anchor sections and other sheet metal parts from **0.075-inch-** thick steel sheet, galvanized after fabrication.
3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from **0.187-inch-** diameter, hot-dip galvanized steel wire.
4. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
 - 2) Heckmann Building Products Inc.; 315-D with 316.
 - 3) Hohmann & Barnard, Inc.; DW-10HS.
 - 4) Wire-Bond; 1004, Type III.
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, having slotted holes for inserting wire tie.

2.6 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Metal Drip Edge: Fabricate from stainless steel. Extend at least **3 inches** into wall and **1/2 inch** out from wall, with outer edge bent down 30 degrees and hemmed.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Metal Sealant Stop: Fabricate from stainless steel. Extend at least **3 inches** into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for **3/4 inch** and down into joint **1/4 inch** to form a stop for retaining sealant backer rod.
3. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Elastomeric Thermoplastic Vinyl with UV Stabilizer and non-migratory plasticizers: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. **Basis-of-Design Product:** Subject to compliance with requirements, provide Total Flash by Mortar Net or approved comparable product:
 - 1) **DuPont; Thru-Wall Flashing.**
 - 2) **Hohmann & Barnard, Inc.;** Flex-Flash.
 - 3) **Hyload, Inc.;** Hyload Cloaked Flashing System.
 - 4) **Mortar Net USA, Ltd.;** Total Flash.
2. Termination Bar: 16-gauge stainless steel.
 - a. Pre-attached termination designed to fasten flashing system to the substrate or tucked into mortar joint.
3. Drip Edge Options: 26-gauge 304 stainless steel.
4. Mortar Collection Weep Tabs:
 - a. Polyester impregnated with biocide mold resistant material in a woven mesh.
 - b. Integrated weep tabs adhered to flashing membrane.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following unless otherwise indicated:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth **1/8 inch** less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Advanced Building Products Inc.; Mortar Maze weep vent.
- 2) Blok-Lok Limited; Cell-Vent.
- 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
- 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
- 5) Hohmann & Barnard, Inc.; Quadro-Vent.
- 6) Wire-Bond; Cell Vent.

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth **1/8 inch** less than depth of outer wythe; in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Advanced Building Products Inc.; Mortar Break.
- b. Archovations, Inc.; CavClear Masonry Mat.
- c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
- d. Mortar Net USA, Ltd.; Mortar Net.

2. Provide one of the following configurations:

- a. Strips, full-depth of cavity and **10 inches** high, with dovetail shaped notches **7 inches** deep.
- b. Sheets or strips full depth of cavity and installed to full height of cavity.

2.8 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
- C. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type N.
 - 3. For mortar parge coats, use Type N.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, use Type N.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- b. Pre-faced CMUs.
 - c. Concrete facing brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than **2000 psi**.
 - 3. Provide grout with a slump of **8 to 11 inches** as measured according to ASTM C 143/C 143M.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
 - 1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units:
 - a. Pre-faced CMUs.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus **1/2 inch** or minus **1/4 inch**.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus **1/2 inch**.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus **1/4 inch** in a story height or **1/2 inch** total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than **1/4 inch in 10 feet**, or **1/2 inch** maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet**, **1/4 inch in 20 feet**, or **1/2 inch** maximum.
3. For vertical lines and surfaces do not vary from plumb by more than **1/4 inch in 10 feet**, **3/8 inch in 20 feet**, or **1/2 inch** maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 feet**, **1/4 inch in 20 feet**, or **1/2 inch** maximum.
5. For lines and surfaces do not vary from straight by more than **1/4 inch in 10 feet**, **3/8 inch in 20 feet**, or **1/2 inch** maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**, with a maximum thickness limited to **1/2 inch**.
2. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch** or minus **1/4 inch**.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal **4-inch** horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout **24 inches** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch** on exterior side of walls, **1/2 inch** elsewhere. Lap reinforcement a minimum of **6 inches**.
 - 1. Space reinforcement not more than **16 inches** o.c.
 - 2. Space reinforcement not more than **8 inches** o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than **8 inches** above and below wall openings and extending **12 inches** beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints. Provide not less than **2 inches** of air space between back of masonry veneer and face of sheathing.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than **16 inches** o.c. vertically and 16 inches o.c. horizontally with not less than 1 anchor for each **2.67 sq. ft.** of wall area. Install additional anchors within **12 inches** of openings and at intervals, not exceeding **36 inches**, around perimeter.

3.7 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels and shelf angles, extend flashing a minimum of **6 inches** into masonry at each end. At heads and sills, extend flashing **6 inches** at ends and turn up not less than **2 inches** to form end dams.
 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch** back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch** back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Space weep holes **24 inches** o.c. unless otherwise indicated.
 3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft.** of wall area or portion thereof.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.9 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of **3/4 inch**.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.10 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Protect surfaces from contact with cleaner.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within **18 inches** of finished grade.
 - 2. All fill material shall be reviewed by the project special inspector.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 04 20 01 - MASONRY VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete block.
- B. Mortar.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Installation of lintels.
- F. Accessories.

1.2 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement.
- C. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
- D. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- E. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- F. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

1.3 PRE-INSTALLATION MEETING

- A. Pre-Installation Meeting: Convene at least one week before starting work of this section.
 - 1. Discuss each step of preparation, installation, and cleaning operations.
 - 2. Discuss the application of control joints, sealants, and liquid applied products.
 - 3. Discuss the protection of masonry before and after installation.

1.4 SUBMITTALS

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- B. Samples for Verification: Submit two (2) full size physical samples of decorative block units to illustrate color, texture, and extremes of color range.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Pre-Faced Units: 50 of each type, size, and color combination.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.7 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Split Face Concrete Block: Comply with referenced standards and as follows:
 - 1. General Note: Block style and type to match existing conditions.
 - 2. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 - 3. Special Shapes: Provide non-standard blocks configured for corners.
 - a. Provide units finished on front and side at outside corners.
 - 4. Non-Loadbearing Units: ASTM C129.

- a. Hollow block, as indicated.

2.2 MORTAR MATERIALS

- A. Masonry Cement: ASTM C91/C91M Type N.
- B. Grout Aggregate: ASTM C404.
- C. Water: Clean and potable.

2.3 REINFORCEMENT AND ANCHORAGE

- A. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches.

2.4 ACCESSORIES

- A. Pre-formed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Multicomponent Cavity Wall Drainage System: Combination mortar diverter, flashing and weep system.
 - 1. Products: Subject to compliance with requirements, provide Mortar Net Solutions, TotalFlash or approved equivalent product.
 - a. Submit substitution request per Section 01 25 00 Substitution Procedures to propose approved equivalent products.
- D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.5 MORTAR MIXING

- A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
- B. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: As indicated on Drawings.
 - 2. Coursing: As indicated on Drawings.
 - 3. Mortar Joints: Concave.

3.3 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.

- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.4 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

3.5 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.6 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
- C. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
- D. Support flexible flashings across gaps and openings.

3.7 LINTELS

- A. Install loose steel lintels over openings. Refer to Section 05 12 00 Structural-Steel Framing and Structural drawings for more information.

3.8 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.9 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

3.10 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, and other penetrations. Coordinate with other sections of work to provide correct size, shape, and location.

3.11 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work in color, appearance, and texture.
- C. Clean soiled surfaces with a manufacturer recommended cleaning solution.
- D. Use non-metallic tools in cleaning operations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.12 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 20 01

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Architectural cast stone.

1.2 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- G. ASTM C150/C150M - Standard Specification for Portland Cement.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- J. ASTM C1364 - Standard Specification for Architectural Cast Stone.

1.3 SUBMITTALS

- A. Product Data: Test results of cast stone components made previously by the manufacturer.
 - 1. Include one copy of ASTM C1364 for Architect's use.
- B. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- C. Verification Samples: Provide two pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Cast Stone:
 - 1. Any current producer member of the Architectural Precast Association or Cast Stone Institute.

2.2 ARCHITECTURAL CAST STONE

- A. General Note: Cast stone to match size and type of existing cast stone.
- B. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 4. Remove cement film from exposed surfaces before packaging for shipment.
- C. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 2. Unless otherwise indicated on drawings, provide:
 - a. A wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- D. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.3 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, as specified in Section 04 05 11 ; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine construction to received cast stone components. Document any unacceptable conditions and notify Contractor if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.3 TOLERANCES

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Remove excess mortar from face of stone before pointing joints.
 - 2. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
 - 3. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".
- B. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
 - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
 - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
- B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
- C. Repair methods and results subject to Architect 's approval.

3.5 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.6 PROTECTION

- A. Protect completed work from damage.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION 04 72 00

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior load and non-load-bearing wall framing.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Design framing systems to withstand **design loads** without deflections greater than the following:
 - a. Exterior Load and Non-Load-Bearing Framing: Horizontal deflection of **1/600** of the wall height for locations backing masonry veneer, **1/360** for all other locations.
 - 3. Design framing systems to provide for movement of framing members 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. 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 **1 inch**.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior load and non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- 5. Vertical deflection clips.
- 6. Horizontal drift deflection clips
- 7. Miscellaneous structural clips and accessories.
- F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the 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, ductility, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. Allied Studco.
 - 2. AllSteel Products, Inc.
 - 3. California Expanded Metal Products Company.
 - 4. Clark Steel Framing.
 - 5. Consolidated Fabricators Corp.; Building Products Division.
 - 6. Craco Metals Manufacturing, LLC.
 - 7. Custom Stud, Inc.
 - 8. Dale/Incor.
 - 9. Design Shapes in Steel.
 - 10. Dietrich Metal Framing; a Worthington Industries Company.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: **ST50H**.
 2. Coating: **G60**.
- B. Steel Sheet for **Vertical Deflection** Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: **50**, Class 1 or 2.
 2. Coating: G90.

2.3 EXTERIOR LOAD AND 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-Metal 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-Metal Thickness: Matching steel studs, unless noted otherwise.
 2. Flange Width: **1-1/4 inches, unless noted otherwise**.
- C. Vertical Deflection Clips: as indicated.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- 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 and lateral loads and transfer them to the primary structure, and as follows:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Minimum Base-Metal Thickness: **0.0428 inch**.
 4. Flange Width: **2-1/2 inches**.
- 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 and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: **0.0428 inch**.
 - b. Flange Width: **2-1/2 inches**.
 2. Inner Track: Of web depth indicated, and as follows:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Minimum Base-Metal Thickness: **0.0428 inch.**
- b. Flange Width: **1-1/4 inches.**
- 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.

2.4 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, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.5 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 capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent 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.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Cement Grout: Portland cement, ASTM C 150, 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, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 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 screw penetrating joined members by not less than three exposed screw threads.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance 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 shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal 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.
1. 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 are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to 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 metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Comply with AWS D1.3 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, and complying 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 comparable in intensity 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 and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing 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 standard punched openings.
- J. Erection Tolerances: Install cold-formed metal 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 EXTERIOR LOAD AND NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: **16 inches max.**
- 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-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 studs and anchor to building structure.
 - 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at **96-inch** centers.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 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.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.
- B. Downspout boots.
- C. Metal Bollards

1.2 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- I. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings.
- J. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings.
- K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- L. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- M. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
- N. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).
- O. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.
- P. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric).
- Q. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- R. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- W. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
- X. SSPC-SP 2 - Hand Tool Cleaning.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Fasteners .
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy , T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy , T6 temper.
- E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.
- F. Aluminum-Alloy Die Castings: ASTM B85/B85M.
- G. Bolts, Nuts, and Washers: Stainless steel.
- H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

2.5 DOWNSPOUT BOOTS

- A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, and cleanout cover.
 - 1. Material: Cast iron or steel.
 - 2. Finish: Manufacturer's standard factory applied powder coat finish.
 - 3. Color: To be selected by Architect from manufacturer's standard range.

2.6 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.7 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 50 00

SECTION 05 75 00 - DECORATIVE FORMED METAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior fabrications made of formed metal sheet, secondary supports, and anchors to structure, including:
 - 1. Closures, trim, and filler panels.

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

- A. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - 1. Differentiate between shop and field fabrication.
 - 2. Indicate substrates and adjacent work with which the fabrications must be coordinated.
 - 3. Include large-scale details of anchorages and connecting elements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Protect finishes by applying heavy duty removable plastic film during production.
 - 2. Package for protection against transportation damage.
 - 3. Provide markings to identify components consistently with drawings.
 - 4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 1. Store in well ventilated space out of direct sunlight.
 - 2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
 - 3. Store at a slope to ensure positive drainage of any accumulated water.
 - 4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F.
 - 5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

PART 2 PRODUCTS

2.1 FORMED METAL FABRICATIONS - GENERAL

- A. Coordination: Coordinate dimensions and attachment method with Owner for Owner-provided decorative metal.
- B. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.
- C. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

- A. Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.
- B. Do not cut or abrade sheet metal finishes that cannot be completely restored in the field.
- C. Use concealed anchorages where possible. Provide washers where needed on bolts or screws to protect metal surfaces and make weathertight connection.
- D. Form tight joints with exposed connections accurately fitted together.

3.4 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Clean installed products in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. Protect installed products from damage during construction.

END OF SECTION 05 75 00

SECTION 06 10 10 - NON-STRUCTURAL ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Communications and electrical room mounting boards.
- B. Concealed wood blocking, nailers, and supports.
- C. Non-structural miscellaneous wood nailers, furring, and grounds.

1.2 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood.
- G. PS 20 - American Softwood Lumber Standard.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation. Do not stack wood products in contact with ground.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimensional Lumber: Comply with PS 20.
 - 1. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 2. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSIONAL LUMBER

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

2.3 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: Kiln-dry (15 percent maximum).
- C. Surfacing: S4S.
- D. Species: Douglas Fir.
- E. Grade: No. 3, 3 Common, or Standard.

2.4 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.5 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

2.6 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification Ausing waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Treat lumber less than 18 inches above grade.
 - e. Treat lumber in other locations as indicated.
 - 2. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification Fusing waterborne preservative.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat plywood in contact with masonry or concrete.
 - c. Treat plywood less than 18 inches above grade.
 - d. Treat plywood in other locations as indicated.
 - 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWP A U1, Use Category UC4A, Commodity Specification Ausing waterborne preservative.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.

- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.3 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.4 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.5 CLEANING

- A. Comply with applicable regulations.
- B. Do not burn scrap on project site.
- C. Do not burn scraps that have been pressure treated.
- D. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- E. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- F. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 10

SECTION 07 13 00 - SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sheet Waterproofing:
 - 1. Self-adhered modified bituminous sheet membrane.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

1.3 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
- C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- E. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems.
- F. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- H. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- I. NRCA (WM) - The NRCA Waterproofing Manual.

1.4 PREINSTALLATION MEETINGS

- A. A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.5 SUBMITTALS

- A. Product Data: Provide data for membrane.
- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.8 WARRANTY

- A. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.1 WATERPROOFING APPLICATIONS

- A. Self-Adhered Modified Bituminous Sheet Membrane:

2.2 MEMBRANE MATERIALS

- A. Self-Adhered Modified Bituminous Sheet Membrane:
 - 1. Thickness: 60 mil, 0.060 inch, minimum.
 - 2. Sheet Width: 36 inch, minimum.
 - 3. Tensile Strength:
 - a. Membrane: 325 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
 - 4. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
 - 5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
 - 6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
 - 7. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
 - 8. Puncture Resistance: 50 pounds, minimum, measured in accordance with ASTM E154/E154M.
 - 9. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
 - 10. Hydrostatic Resistance: Resists the weight of 200 feet when tested according to ASTM D5385/D5385M.
 - 11. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
 - 12. Products: Subject to compliance with requirements, provide one of the following::
 - a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861
 - b. GCP Applied Technologies; Bituthene 3000
 - c. Henry Company; Blueskin WP 200
 - d. Polyguard Barrier Systems, Inc, a division of Polyguard Products, Inc; TERM Foundation Barrier
 - e. W.R. Meadows, Inc; MEL-ROL
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Sealant: As recommended by membrane manufacturer.
- D. Termination Bars: Aluminum; compatible with membrane and adhesives.
- E. Surface Conditioner: Liquid, waterborne type, compatible with membrane.
- F. Adhesives: As recommended by membrane manufacturer.

2.3 ACCESSORIES

- A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- B. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
 - 1. Composition: Dimpled polystyrene core; polypropylene filter fabric.
 - 2. Products:
 - a. W.R. Meadows, Inc; Mel-Drain5012
 - b. GCP Applied Technologies; Hydroduct Coil 600. www.gcpat.com.

- C. Cant Strips: Bitumen impregnated fiberboard.
- D. Flexible Flashings: Type recommended by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- F. Prepare building expansion joints at locations as indicated on drawings.
- G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
- H. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
 - 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
 - 2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
 - 3. Remove and replace areas of defective concrete as specified in Section 03 30 00.
 - 4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
 - 5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.3 INSTALLATION - MEMBRANE

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- D. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- E. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- F. Install building expansion joints at locations as indicated on drawings.
- G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 4 inches at subsequent plies laid in shingle fashion.
- I. Seal membrane and flashings to adjoining surfaces.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Install termination bar along edges.

3.4 INSTALLATION - DRAINAGE PANEL

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

3.5 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION 07 13 00

SECTION 07 19 00 - WATER REPELLENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water repellents applied to exterior, masonry surfaces.

1.2 REFERENCE STANDARDS

- A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- B. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

1.3 PRE-INSTALLATION MEETING

- A. Pre-Installation Meeting: Convene a meeting at least one week prior to starting work.
 - 1. Attendance by affected installers and Contractor are required.

1.4 SUBMITTALS

- A. Product Data: Provide product description, limitations, and chemical composition.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard color samples.
 - 3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate of each separate coat.
- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- C. Sample Warranty: For Special Warranty.

1.5 QUALITY ASSURANCE

- A. Owner reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.6 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellants to be applied according to manufacturer's written instructions and warranty requirements:
 - 1. Concrete surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 - 3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours minimum.
 - 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 - 5. Rain or snow is not predicted for 24 hours minimum.
 - 6. Not less than 24 hours have passed since surfaces were wet.
 - 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

- A. Provide five year manufacturer warranty for repair and/or replacement of materials that fail to maintain water repellency.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc., Siloxane PD or comparable product by one of the following:
 - a. BASF Construction Chemicals .
 - b. Pecora Corporation .
 - c. Tnemec Company, Inc .
 - d. Pecora Corporation.
 - e. Sika Corporation.

2.2 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 2. Moisture Absorption When Applied to Masonry: 80 percent minimum reduction, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
 3. Moisture Absorption When Applied to Concrete: 80 percent minimum reduction, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
 4. Moisture Absorption When Applied to Clay Brick: 80 percent minimum reduction, when tested in accordance with ASTM C67 brick sample completely coated with water repellent.
 5. Water Vapor Transmission: Comply with one or both of the following:
 - a. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.
 - b. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D 1653.
 6. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.
 7. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.2 PREPARATION

- A. Protection of Adjacent Work:
 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.3 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION 07 19 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and underside of floor slabs.
- B. Batt insulation and vapor retarder in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Spray Foam Insulation for Miscellaneous Voids

1.2 REFERENCE STANDARDS

- A. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.5 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.

2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
5. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Manufacturers:
 - a. Dow Chemical Company.
 - b. Owens Corning Corporation.
 - c. DiversiFoam Products.

2.3 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Manufacturers:
 - a. CertainTeed Corporation.
 - b. Johns Manville.
 - c. Owens Corning Corporation .
 - d. Knauf Insulation.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation .
- B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.
- C. Clean substrate of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.3 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 1. Butt edges and ends tightly to adjacent boards and to protrusions.

- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Adhesive Installation: Where dry-fit installation will not provide continuous insulation plane, install insulation board with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 BOARD INSTALLATION AT CONCRETE SLABS

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.
 - 2. Place insulation under slabs on grade after base for slab has been compacted.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.5 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
- D. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- F. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- G. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- H. Tape seal tears or cuts in vapor retarder.
- I. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.
- B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.2 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) thick base metal.
- B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.3 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Snow guards.

1.2 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
- D. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

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

1.4 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 SNOW GUARDS

- A. Unit Snow Guards: Individual projecting polycarbonate shapes, set between roofing shingles/tiles, and mechanically fastened to roof deck.
 - 1. Projecting Polycarbonate Shapes: Clear polycarbonate plastic with UV stabilizers, semi-circular design.
 - 2. Placement: As indicated on drawings.
 - 3. Color: To match adjacent roof surface.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

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

3.4 CLEANING

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

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.5 PROTECTION

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

END OF SECTION 07 72 00

SECTION 07 84 00 – FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- F. ITS (DIR) - Directory of Listed Products.
- G. FM (AG) - FM Approval Guide.
- H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.
- I. UL (DIR) - Online Certifications Directory.
- J. UL (FRD) - Fire Resistance Directory.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.4 SUBMITTALS

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.5 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Verification of at least five satisfactorily completed projects of comparable size and type.

1.6 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Firestopping Manufacturers: Subject to compliance with requirements provide products by one of the following:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. 3M Fire Protection Products: www.3m.com/firestop.
2. A/D Fire Protection Systems Inc: www.adfire.com.
3. Hilti, Inc: www.us.hilti.com.
4. Specified Technologies Inc: www.stifirestop.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
6. Thermafiber, Inc.: www.thermafiber.com.

2.2 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed. Refer to drawings for fire-resistance ratings.

2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- B. Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.4 FIRESTOPPING SYSTEMS

- A. Firestopping: Penetrations in Fire-Resistance-Rated Walls.
 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- B. Firestopping: Penetrations in Horizontal Assemblies.
 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating of at least one hour, but not less than the fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-sagging gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.2 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C834 - Standard Specification for Latex Sealants.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-Installation conference: Conduct conference at Project Site.

1.4 SUBMITTALS

- A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 7. Sample product warranty.
- B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Sample Installer's Warranty Form.

1.5 CLOSEOUT SUBMITTALS

- A. Installer's Warranty Form.

1.6 WARRANTY

- A. Installer's Warranty: Provide installer's standard form in which installer agrees to repair or replace joint sealants that fail in workmanship within specified warranty period. Include

coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

1. Installer's Warranty Period: Five (5) years from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

- A. ---- EDIT SCOPE CAREFULLY -- Exclude items not applicable, and add others ----
- B. Scope:
 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- C. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
 3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 2. {CH#186516}Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 4. {CH#186532}Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 7. {CH#186546}Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- E. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, other similar items, and [_____].

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.2 JOINT SEALANTS - GENERAL

- A. Colors: As selected by Architect from manufacturer's full range.

2.3 NON-SAG JOINT SEALANTS

- A. ----- Newer Silicones Better Suited For Exterior Use Than Earlier Formulations -----
- B. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses NT; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: To be selected by Architect from manufacturer's standard range.
 6. Cure Type: Single-component, neutral moisture curing.
 7. Service Temperature Range: minus 55 to 250 degrees F degrees F.
 8. Basis of Design Product: Subject to compliance with requirements, provide Dow Corning Corporation 790 Silicone Building Sealant or comparable product by one of the following:
 - a. Dow Corning Corporation; 790 Silicone Building Sealant
 - b. Pecora Corporation; <>
 - c. Sika Corporation; Sikasil WS-290
 - d. Sika Corporation; Sikasil 728NS
 - e. Tremco Commercial Sealants & Waterproofing; Spectrem 1
 - f. Tremco Commercial Sealants & Waterproofing; Tremsil 200
 - g. GE Construction Sealants SCS2700 SilPruf LM.
- C. ----- Conventional Silicone Sealant, Parking Structure and Highway -----
- D. ----- Conventional Silicone Sealant -----
- E. ---- White or Clear Mildew-Resistant -- Often Referred to as Tub and Tile or Kitchen and Bath ---
- F. ----- Interior and Exterior Weather Sealing Applications -----
- G. ----- Newer "Hybrid" Sealants with Reported Longevity of Silicone but Lower Cost -----
- H. ----- Newer "Hybrid" Sealants with Reported Longevity of Silicone but Lower Cost -----
- I. ----- Conventional Polyurethane, Not for Continuous Immersion, Not Tamper-Resistant ----
- J. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 1 or comparable product by one of the following:
 - a. Sika Corporation; Sikaflex-1a
 - b. Sika Corporation; Sikaflex-15 LM
 - c. Sika Corporation; Sikaflex-2c NS
 - d. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC
 - e. W. R. Meadows, Inc; POURTHANE NS
- K. ----- Polyurethane Suitable for Continuous Immersion in Potable Water (not chemicals) ----

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- L. {CH#186652}Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses A, M, T and NT; multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 2 or comparable product by one of the following:
 - a. Sika Corporation
 - b. Pecora Corporation.
- M. ----- Nonsag Traffic-Grade Polyurethane -----
- N. {CH#186664}Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- O. ----- Polyurethane That's Harder Than Normal, to Resist "Picking Out" -----
- P. ---- Epoxy Sealant is Not as Flexible as Others, Use It Where Its Hardness is Desirable ----
- Q. {CH#186678}Epoxy Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 65 to 75, Shore A, when tested in accordance with ASTM C661.
 2. Color: To be selected by Architect from manufacturer's standard range.
 3. Service Temperature Range: Minus 40 to 180 degrees F.
- R. ---- Polysulfides Have Only Medium Movement, Used Primarily for Chemical Resistance ----
- S. ---- Polysulfide is One of Few Suitable for Continuous Water Immersion ----
- T. ---- Newer "Hybrid" Sealant, Much Greater Movement Than Plain Latex ----
- U. ---- Conventional Acrylic Latex, Interior Non-Wet Areas Only, No to Low Movement ----
- V. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
 3. Manufacturers:
 - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant
 - b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant
 - c. Pecora Corporation .
 - d. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
 - e. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke & Sound.
 - f. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke & Sound Spray.
- W. ---- Solvent Based -- Significant VOCs ----
- X. {CH#186751}Butyl Sealant: Rubber-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
 2. Color: To be selected by Architect from manufacturer's standard range.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Service Temperature Range: Minus 13 to 180 degrees F.
 4. Basis of Design Product: Subject to compliance with requirements, provide Pecora Corporation; BC-158 or comparable product by one of the following:
 - a. Bostik, Inc..
- Y. ---- The Only Available Non-Curing Type -- SOLVENT BASED ----
- 2.4 SELF-LEVELING SEALANTS**
- A. ---- Self-Leveling Silicone Sealants -- Must Be Recessed Below Surface ----
 - B. ---- Conventional Self-Leveling Polyurethane Sealant, Assumed to be Traffic-Grade ----
 - C. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: Gray.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Manufacturers:
 - a. Pecora Corporation .
 - b. The QUIKRETE Companies; QUIKRETE® Polyurethane Self-Leveling Sealant.
 - c. Sika Corporation; Sikaflex-1c SL.
 - d. Sika Corporation; Sikaflex-2c SL.
 - D. ---- Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints, Traffic Grade ----
 - E. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
 5. Manufacturers:
 - a. Tremco Commercial Sealants & Waterproofing; THC-901
 - F. ---- Traffic-Grade Polyurethane for Continuous Immersion ----
 - G. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 - H. ----- Newer "Hybrid" Sealants with Reported Longevity of Silicone but Lower Cost -----
 - I. ---- Polysulfides Have Only Medium Movement, Used Primarily for Chemical Resistance ----
 - J. ---- Joint Filler for Concrete Slab Saw-Cuts and Narrow Cracks ----
 - K. ---- Joint Filler for Around Windows and Doors, Thermal and Sound Barrier ----
 - L. {CH#187056}Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
 1. Manufacturers:
 - a. DAP Products Inc; DRAFTSTOP 812 Foam.
 - b. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam.
 - M. ---- Joint Filler for Concrete Slab Saw-Cuts and Narrow Cracks ----

- N. {CH#186854}Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multi-component, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Color: To be selected by Architect from manufacturer's standard colors.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/4 inch.
 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
 7. Manufacturers:
 - a. Dayton Superior Corporation; Pro-Poxy P606.
 - b. Euclid Chemical Company; EUCO 700.
 - c. Nox-Crete; DynaFlex 502.
 - d. W.R. Meadows, Inc; Rezi-Weld Flex.
- O. ---- Joint Filler for Concrete Slab Saw-Cuts and Narrow Cracks ----
- P. ---- Joint Filler for Expansion Joints in Concrete Slabs With Slope Up to 6 Percent ----

2.5 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 2. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal 920 & 921 or comparable product by one of the following:
 - a. Nomaco, Inc .
 - b. Adfast Corporation.
 - c. Alcot Plastics, Ltd.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION 07 92 00

SECTION 080671 – DOOR HARDWARE SETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section references specification sections relating to commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Commercial door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical and access control door hardware.
 - 3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Sections "Flush and Clad Wood Doors".
 - 3. Division 08 Section "Door Hardware".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.
- F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Refer to "PART 3 – EXECUTION" for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

- A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.

1. Section 08 71 00 – Door Hardware.

D. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - Sargent
5. BE - dormakaba Best
6. RF - Rixson
7. NO - Norton
8. SU - Securitron
9. MC - Medeco
10. LU - Lund Equipment Co
11. OT - OTHER

Hardware Sets

Set: 1

Doors: 200-1

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required	PE	087100	
1 Removable Mullion	L980S / L980A (As Required) x Length Required	PC	SA	087100
1 Exit Device (NL, RX, ELR)	LD 55 56 70 AD8504 Less Pull (Less Mech Dogging)	US32D	SA	087100 ⚡
1 Exit Device (EO, RX)	LD 55 AD8510 (Less Mech Dogging)	US32D	SA	087100 ⚡
2 SFIC Core	Keyway and pinned to match existing system	626	BE	087100
1 Mullion Cylinder and Kit	70 980C1 (SFIC Housing)	US26D	SA	087100
1 Rim Cylinder Housing	3_ tailpiece to suit	US32D	SA	087100
2 Door Pull	RM3331-36 Mtg-Type 12XHD	US32D	RO	087100
2 Surface Closer	UNI7500	689	NO	087100
2 Blade Stop Spacer Kit	6891 (where Required)	689	NO	087100
2 Drop Plate	7788 (where Required)	689	NO	087100
1 Threshold	273x224AFGT x Length Required x MSES25SS		PE	087100
2 Sweep	3452CNB x Length Required		PE	087100
2 Harness Adaptor	52-2946		SA	

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2 Electric Power Transfer	EL-CEPT	SU 087100 ⚡
1 Card Reader	By Security Supplier	
2 ElectroLynx Harness	QC-C**** x Length Required	MK 087100 ⚡
2 ElectroLynx Harness	QC-C1500P	MK 087100 ⚡
2 Position Switch	DPS2 - M / W-BK	SU 087100 ⚡
1 Power Supply	BPS (Size & Type as Required)	SU 087100 ⚡
1 Wiring Diagram	Elevation and Point to Point as Specified	OT

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:

- Doors normally closed and secure.
- Access by valid credential presentation retracting latch on the active leaf for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 2

Doors: 200-2, 200-4, 200-5

2 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE 087100
1 Removable Mullion	L980S / L980A (As Required) x Length Required	PC SA 087100
1 Rim Exit Device (STRM)	16 70 AD8506 ETL (Cyl. Dogging)	US32D SA 087100
1 Rim Exit Device (EO, DT)	16 70 AD8510 ETL (Cyl. Dogging)	US32D SA 087100
4 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
1 Mullion Cylinder and Kit	70 980C1 (SFIC Housing)	US26D SA 087100
3 Mortised Cylinder Housing	Size and Cam as required	US26D SA 087100
2 Surface Closer	CLP7500	689 NO 087100
2 Blade Stop Spacer Kit	6891 (where Required)	689 NO 087100
2 Drop Plate	7788 (where Required)	689 NO 087100

Notes: Weatherstrip and Astragals by Aluminum Door Manufacturer.

Set: 3

Doors: 222-1

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE	087100
1 Office Lock (SFIC)	28 41 70 10G05 LL	US26D SA	087100
1 SFIC Core	Keyway and pinned to match existing system	626 BE	087100
1 Surf Overhead Stop	10-X36	630 RF	087100
1 Surface Closer	7500 (Reg or P/A)	689 NO	087100
1 Blade Stop Spacer Kit	6891 (where Required)	689 NO	087100
1 Drop Plate	7788 (where Required)	689 NO	087100

Notes: Minimum 5" Door Stile is required to accommodate the cylindrical lockset.

Set: 4

Doors: 207-1

3 Hinge	TA2714	US26D MK	087100
1 Privacy Lock	28 10U65 LL	US26D SA	087100
1 Surface Closer	7500 (Reg or P/A)	689 NO	087100
1 Kick Plate	K1050 10" high BEV CSK	US32D RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D RO	087100
1 Gasketing	S88D (Head & Jamb)	PE	087100

Set: 5

Doors: 200-6

2 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE	087100
1 Removable Mullion	L980S / L980A (As Required) x Length Required	PC SA	087100
1 Rim Exit Device (STRM)	16 70 AD8506 ETL (Cyl. Dogging)	US32D SA	087100
1 Rim Exit Device (EO, DT)	16 70 AD8510 ETL (Cyl. Dogging)	US32D SA	087100
4 SFIC Core	Keyway and pinned to match existing system	626 BE	087100
1 Mullion Cylinder and Kit	70 980C1 (SFIC Housing)	US26D SA	087100
3 Mortised Cylinder Housing	Size and Cam as required	US26D SA	087100
2 Surface Closer	UNI7500	689 NO	087100
1 Threshold	273x224AFGT x Length Required x MSES25SS	PE	087100
2 Sweep	3452CNB x Length Required	PE	087100
2 Position Switch	DPS2 - M / W-BK	SU	087100 ⚡

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

System Operational Narrative:

- Doors normally closed and secure.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.

Set: 6

Doors: 215-1

6 Hinge	TA2714	US26D MK 087100
1 Dust Proof Strike	570	US26D RO 087100
2 Flush Bolt	555 / 557 (As Required)	US26D RO 087100
1 Storeroom Lock	28 41 70 10G04 LL	US26D SA 087100
1 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
2 Surface Closer	CLP7500	689 NO 087100
2 Kick Plate	K1050 10" high BEV CSK	US32D RO 087100
1 Threshold	2009APK x Length Required x MSES25SS	PE 087100
1 Gasketing	S88D (Head & Jambs)	PE 087100
1 Astragal	S771C x Door Height	PE 087100

Set: 7

Doors: 200-3

2 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE 087100
1 Removable Mullion	L980S / L980A (As Required) x Length Required	PC SA 087100
1 Rim Exit Device (STRM)	16 70 AD8506 ETL (Cyl. Dogging)	US32D SA 087100
1 Rim Exit Device (EO, DT)	16 70 AD8510 ETL (Cyl. Dogging)	US32D SA 087100
4 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
1 Mullion Cylinder and Kit	70 980C1 (SFIC Housing)	US26D SA 087100
3 Mortised Cylinder Housing	Size and Cam as required	US26D SA 087100
2 Surface Closer	CLP7500	689 NO 087100
2 Blade Stop Spacer Kit	6891 (where Required)	689 NO 087100
2 Drop Plate	7788 (where Required)	689 NO 087100
1 Position Switch	DPS2 - M / W-BK	SU 087100 ⚡

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

System Operational Narrative:

- Doors normally closed and secure.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.

Set: 8

Doors: 216-4, 234-1

1 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE 087100
1 Exit Device (STRM)	16 70 8804 ETL (Cyl. Dogging)	US32D SA 087100
1 Surface Closer	UNI7500	689 NO 087100
1 Armor Plate	K1050 36" high BEV CSK	US32D RO 087100
1 Threshold	273x224AFGT x Length Required x MSES25SS	PE 087100
1 Gasketing	303AS (Head & Jambs)	PE 087100
1 Rain Guard	346C x Width of Frame Head	PE 087100
1 Sweep	3452CNB x Length Required	PE 087100
1 Position Switch	DPS2 - M / W-BK	SU 087100 ⚡

Notes: System Operational Narrative:

- Door normally closed and secure.
- Door position switch provides open/closed monitoring to both access control system and intrusion alarm service.

Set: 9

Doors: 213-3

2 Continuous Hinge	CFM_SLF-HD1 x Length Required	PE 087100
1 Dust Proof Strike	570	US26D RO 087100
2 Flush Bolt	555 / 557 (As Required)	US26D RO 087100
1 Storeroom Lock	28 41 70 10G04 LL	US26D SA 087100
1 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
2 Armor Plate	K1050 36" high BEV CSK	US32D RO 087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D RO 087100
2 Silencer	608	RO 087100

Notes: Doors Open to 180 Degrees

Set: 10

Doors: 230-1

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3 Hinge	TA2714	US26D MK 087100
1 Passage Latch	28 10U15 LL	US26D SA 087100
1 Armor Plate	K1050 36" high BEV CSK	US32D RO 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D RO 087100
3 Silencer	608	RO 087100

Set: 11

Doors: [212-2](#), 213-4, 214-2

3 Hinge	TA2714	US26D MK 087100
1 Storeroom Lock	28 41 70 10G04 LL	US26D SA 087100
1 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
1 Surface Closer	7500 (Reg or P/A)	689 NO 087100
1 Armor Plate	K1050 36" high BEV CSK	US32D RO 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D RO 087100
1 Gasketing	S88D (Head & Jambs)	PE 087100

Set: 12

Doors: 216-2, 216-3

1 SFIC Core	Keyway and pinned to match existing system	626 BE 087100
1 Mortised Cylinder Housing	Size and Cam as required	US26D SA 087100
1	All Hardware Provided By Door Supplier	

Notes: Door is Push/Push. No Locking function.

Set: 13

Doors: 201-1, 202-1, 204-1, 205-1, 206-1, 208-1, 210-1, 211-1, 223-1, 224-1, 225-1, 226-1, 227-1, 228-1, 229-1, 231-1, 232-1, 233-1

3 Hinge	TA2714	US26D MK 087100
1 Office Lock	PBR 8809FL	630 YA 087100
1 Cylinder	type as required	626 YA 087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D RO 087100
1 Silencer	608	RO 087100

Set:14

Doors: 212-1, 213-2, 214-1, 214-3, 217-1, 217-2, 218-1, 219-1, 220-1, 221-1

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3 Hinge	TA2714 (NRP and Size as Required)	US26D	MK	087100
1 Classroom Security Lock	28 41 70 10G38 LL	US26D	SA	087100
1 SFIC Core	Keyway and pinned to match existing system	626	BE	087100
1 Surface Closer	7500 (Reg or P/A)	689	NO	087100
1 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
3 Silencer	608		RO	087100

Set:15

Doors: 213-1, 216-1

2 Continuous Hinge	CFM_SLF-HD1 x Length Required		PE	087100
1 Removable Mullion	L980S / L980A (As Required) x Length Required	PC	SA	087100
2 Classroom Security Lock	28 41 70 10G38 LL	US26D	SA	087100
2 SFIC Core	Keyway and pinned to match existing system	626	BE	087100
2 Surface Closer	7500 (Reg or P/A)	689	NO	087100
2 Kick Plate	K1050 10" high BEV CSK	US32D	RO	087100
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO	087100
6 Silencer	608		RO	087100

END OF SECTION 080671

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 08 Section "Access Control Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. NFRC 102 – Procedure for Measuring the Steady State Thermal Transmittance of Fenestration Systems.
16. NFRC 400 – Procedure for Determining Fenestration Product Air Leakage.
17. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
18. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
 - D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
 - E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.
 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
 - F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Design: Flush panel.
 2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.
 - a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
1. Curries Company (CU) - Polystyrene Core - 707 Series.
 2. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – Thermal Break TQ Series.
- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - CM Series.
 - b. Curries Company (CU) - M Series.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow metal work immediately after installation.
 - C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.2 REFERENCE STANDARDS

- A. ASTM C1036 - Standard Specification for Flat Glass.
- B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.
- C. ITS (DIR) - Directory of Listed Products.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NFPA 70 - National Electrical Code.
- G. UL (DIR) - Online Certifications Directory.
- H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- B. Product Data: Show component construction, anchorage method, and hardware.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

- A. Operation Data: Include normal operation, troubleshooting, and adjusting.
- B. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- C. Manufacturer's Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 WARRANTY

- A. Correct deterioration of factory-applied finishes within ten year period after Date of Substantial Completion.
- B. Warranty: Include coverage for electric motor and transmission.
 - 1. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.1 ALUMINUM DOORS

- A. Aluminum Doors: Stile and rail aluminum with glazed panels; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide Haas, CA220 or equivalent product from one of the following:
 - a. Clopay Building Products.
 - b. C.H.I. Overhead Doors.
 - c. Overhead Door Corporation.
 - d. Wayne Dalton, a division of Overhead Door Corporation.
 - 2. Door Nominal Thickness: 1-3/4 inches thick.
 - 3. Finish: Factory anodized; clear anodized.
 - 4. Glazed Lights: Five (5) glazed lights per panel, one row; set in place with resilient glazing channel.

5. Electric Operation: Electric control station.

B. Glazing: Annealed float glass; insulated; clear; 1/8 inch thick.

2.2 COMPONENTS

- A. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
 - 1. For Manual Operation: Requiring maximum exertion of 25 lbs force to open.
 - 2. Spring Life-Cycle: 100,000 cycles.
- C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- E. Head Weatherstripping: EPDM rubber seal, one piece full length.
- F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

2.3 MATERIALS

- A. Float Glass: Provide float glass glazing, unless noted otherwise.
 - 1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
- B. Insulated Glass: Provide insulated glazing, unless noted otherwise.
 - 1. Glazing: Tempered.
 - 2. Total Unit Thickness: 1/2 inch.

2.4 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 - 1. Mounting: Center mounted on cross head shaft.
 - 2. Motor Enclosure:
 - 3. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 4. Controller Enclosure: NEMA 250, Type 1.
 - 5. Opening Speed: 12 inches per second.
 - 6. Brake: Adjustable friction clutch type, activated by motor controller.
 - 7. Manual override in case of power failure.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at interior door jamb.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.
- F. Provide interconnection to security system.
- G. Operation: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.3 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install perimeter trim.

3.4 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.5 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.6 CLEANING

- A. Clean doors and frames.
- B. Remove temporary labels and visible markings.

3.7 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION 08 36 13

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of metal and glass.
- C. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- C. Section 08 80 00 - Glazing: Glass and glazing accessories.
- D. Section 12 24 00 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site .
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) .
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum .
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections .
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures .
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes .
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) .
- H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference .
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference .

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill,{CH#243558} internal drainage details{CH#51522}.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - C. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
 - D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- 1.06 CLOSEOUT SUBMITTALS
- A. Owner's Manual and Maintenance Data.
 - B. Manufacturer's Glazing Warranty Form.
 - C. Manufacturer's Finish Warranty Form.
- 1.07 QUALITY ASSURANCE
- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- 1.08 DELIVERY, STORAGE, AND HANDLING
- A. Handle products of this section in accordance with AAMA CW-10.
 - B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
- 1.09 FIELD CONDITIONS
- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.
- 1.10 WARRANTY
- A. Manufacturer's Glazing Warranty:
 - 1. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
 - a. Failure include, but are not limited to, the following:
 - b. Structural failures, including but not limited to, excessive deflection.
 - c. Noise or vibration created by wind and thermal and structural movements
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - e. Water penetration through fixed glazing and framing areas.
 - f. Failure of operating components.
 - B. Manufacturer's Finish Warranty:
 - 1. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1) Deterioration includes, but is not limited to, the following:
 - a) Color fading more than 5 Hunter 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.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally Broken, above 12'-0" in height:
 - 1. Basis-of-Design: Subject to compliance with requirements, provide EFCO Corporation, Series 403T, Thermal Storefront Framing or comparable product by one of the following:
 - a. Kawneer North America, an Alcoa company.
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

- A. Center-Set Style:
 - 1. Basis of Design: Subject to compliance with requirements, provide, EFCO Corporation; Series 401, Storefront Framing or a comparable product by one of the following:
 - a. Kawneer North America; An Alcoa Company
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.03 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Insulating Glazing, Thermally-Broken:
 - 1. Basis of Design: Subject to compliance with requirements, provide EFCO Corporation; Series D502 Thermastile or a comparable product by one of the following:
 - a. Kawneer North America; an Alcoa company.
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.04 MANUFACTURERS

- A. Aluminum-Framed Storefront and Doors:
 - 1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/#sle.
 - 2. Kawneer North America: www.kawneer.com/#sle.

3. Manko Window Systems, Inc: www.mankowindows.com/#sle.
4. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
5. Tubelite, Inc: www.tubeliteinc.com/#sle.

2.05 STOREFRONT

- A. Storefront system to be engineered by storefront manufacturer for mullion sizing and any required backup steel framing. Coordinate any required backup steel with Pre-Engineered Metal Building Manufacturer.
- B. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.
 2. Finish:
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 3. Finish Color: As selected by Architect from manufacturer's standard line.
 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
- C. Performance Requirements:
 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.06 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
 2. Cross-Section: As indicated on drawings.
- B. Glazing: As specified in Section 08 80 00.

2.07 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- D. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.
- E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.08 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Color: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.05 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 43 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.
- B. Column covers.

1.2 RELATED REQUIREMENTS

- A. Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- G. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- H. Designer's Qualification Statement.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN - CURTAIN WALL SYSTEMS

2.2 CURTAIN WALL

- A. Curtain wall system to be engineered by curtain wall manufacturer for mullion sizing and any required backup steel framing. Coordinate any required backup steel with Pre-Engineered Metal Building Manufacturer.
- B. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Vertical Mullion Dimensions: Per Curtain wall manufacturer calculations including backup steel required.
 - 2. Finish: Class I natural anodized.
 - a. Factory finish surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - 3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- C. Structural Performance Requirements: Design and size components including back-up steel as required to withstand the following load requirements without damage or permanent set.
 - 1. Design Wind Loads: Comply with the following:
 - a. Positive Design Wind Load: Per Structural Drawings.
 - b. Negative Design Wind Load: Per Structural Drawings.

- c. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
- 2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.
- 3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - a. Expansion and contraction caused by 180 degrees F surface temperature.
 - b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
 - c. Movement of curtain wall relative to perimeter framing.
 - d. Deflection of structural support framing, under permanent and dynamic loads.
- D. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
 - 1. Test Pressure Differential: 10 psf.

2.3 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
- B. Glazing: As specified in Section 08 80 00.

2.4 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- C. Glazing Accessories: As specified in Section 08 80 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

3.4 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 44 13

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 5. Division 08 Section "Access Control Hardware".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual surface door closer bodies.
 - 4. Five years for motorized electric latch retraction exit devices.
 - 5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Hager Companies (HA).
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
- c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.

- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

- 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
- 2. Furnish dust proof strikes for bottom bolts.
- 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
- 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

- a. Door Controls International (DC).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

- 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
- 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
- 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
- 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

- a. Stanley Best (BE).

- B. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 5. Keyway: Match Facility Standard.
- C. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
1. Manufacturers:
 - a. Stanley Best (BE) - 1CK Best/Peaks Series.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
 4. Construction Control Keys (where required): Two (2).
 5. Permanent Control Keys (where required): Two (2).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Construction Keying: Provide temporary keyed construction cores.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.
- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

P. Electronic Key Management System: Provide an electronic key control system with Stand-alone Plug and Play features including advanced RFID technology. Touchscreen interface with PIN access for keys individually locked in place. Minimum 1,000 system users and 21 iFobs for locking receptors. System shall have a minimum 250,000 audit events screen displayed or ability to be exported via USB port.

1. Manufacturers:

- a. Medeco (MC).
- b. Traka (TA).

Q. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

- 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
- 2. Locks are to be non-handed and fully field reversible.
- 3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
- 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
 - b. Sargent Manufacturing (SA) – 10 Line.
 - c. Stanley Best (BE) – 9K Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Stanley Precision (PR) - Apex 2000 Series.
- C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
1. Provide keyed removable feature where specified in the Hardware Sets.
 2. Provide stabilizers and mounting brackets as required.
 3. Provide electrical quick connection wiring options as specified in the hardware sets.
 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - 700/900 Series.
 - b. Sargent Manufacturing (SA) - 980S Series.
 - c. Yale Locks and Hardware (YA) - M200 Series.

2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Door Controls (NO) - 7500 Series.
 - c. Yale Locks and Hardware (YA) - 4400 Series.
- C. Door Closers, Surface Mounted (Unitrol): Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - Unitrol Series.
 - b. Norton Door Controls (NO) - Unitrol Series.
 - c. Yale Locks and Hardware (YA) - Unitrol Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Sargent Manufacturing (SA).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 - 2. Reese Enterprises, Inc. (RE).
 - 3. Zero (ZE).

2.13 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Security Door Controls (SD) - DPS Series.
 - b. Securitron (SU) - DPS Series.
- B. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.
 - 1. Manufacturers:
 - a. Sargent Manufacturing (SA) – WT2 Wiegand Test Unit.
- C. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 3500 Series.

- b. Securitron (SU) - BPS Series.

2.14 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

SECTION 08 80 00 – GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films.
- D. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 36 13 - Sectional Doors: Glazed lites in doors.
- C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- D. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM C1036 - Standard Specification for Flat Glass.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- I. GANA (SM) - GANA Sealant Manual.
- J. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting a minimum 5 business days before starting work of this section; require attendance by each of the affected installers.

1.5 SUBMITTALS

- A. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, Plastic Film, and [] Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- B. Samples: Submit two sample 12 inch by 12 inch in size of glass units.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.

- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

- A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

- A. Glass Fabricators:
 - 1. Trulite Glass & Aluminum Solutions, LLC .
 - 2. Guardian Glass, LLC.
 - 3. Oldcastle Building Envelope.
 - 4. Pilkington North America, Inc.
 - 5. Vitro Architectural Glass.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
 - 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with applicable codes and as indicated on Drawings.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
 - 5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT, Condition A, (uncoated) unless
3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.4 INSULATING GLASS UNITS

- A. Manufacturers:
1. Any of the manufacturers specified for float glass.
 2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
 3. Cardinal Glass Industries; [____]: www.cardinalcorp.com/#sle.
 4. Guardian Glass, LLC; [____]: www.guardianglass.com/#sle.
 5. Viracon, Apogee Enterprises, Inc; [____]: www.viracon.com/#sle.
 6. Vitro Architectural Glass (formerly PPG Glass); [____]: www.vitroglazings.com/#sle.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Perimeter Spacers: Manufacturer's standard space material and construction.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Technoform Glass Insulation; TGI-Spacer: www.glassinsulation.us.
 - 2) Thermix; a brand of Ensigner USA; Thermix: www.thermix.de.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide manufacturer's standard primary and secondary sealants.
 6. Purge interpane space with dry air, hermetically sealed.

2.5 INSULATING GLASS SCHEDULE

- A. Type GL1 - Insulating Glass Units: Low-E, tinted insulating glass.
1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Tint: Gray. Basis of Design: Vitro Optigray
 4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E, sputtered on #3 surface.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Summer Daytime: 0.27 maximum, nominal.
 7. Thermal Transmittance (U-Value), Winter Nighttime: 0.29 maximum, nominal.
 8. Visible Light Transmittance (VLT): 0.35 minimum percent, nominal.
 9. Solar Heat Gain Coefficient (SHGC): 0.29 maximum, nominal.
 10. Visible Light Reflectance, Outside: 0.35 minimum percent, nominal.
 11. Safety glazing and bullet resistant film as indicated in Drawings.

2.6 GLAZING UNIT SCHEDULE

- A. Type GL2 - Monolithic Interior Vision Glazing:
 - 1. Applications: Interior glazing unless otherwise indicated.
 - 2. Glass Type: Heat-strengthened float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch, nominal.
 - 5. Safety glazing and bullet resistant film as indicated on Drawings.

2.7 PLASTIC FILMS

- A. Type F-2 - Safety and Security Plastic Film: Polyester type.
 - 1. Application: Locations as indicated on drawings.
 - 2. Impact Resistance: Comply with ANSI Z97.1 and 16 CFR 1201 impact test requirements when applied to 1/8 inch thick annealed glass.
 - 3. Color: Clear.
 - 4. Thickness Without Liner: 0.002 inch.
 - 5. Manufacturers:
 - a. Armoured One LLC: www.ArmouredOne.com
 - 1) Tactical Security Film 21MIL single layer or Approved Equal.
 - 6. Referenced Standards:
 - a. WEY-SA-C1 - Standard for shooter/attack certification and forced entry.
 - b. GSA Level C - General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
 - c. ASTM F1642 - Standard Test Method for Glazing and Glazing Systems Subject to Air Blast Loadings.
 - d. UL972 - Standard for Burglary Resisting Glazing.
 - e. EN356 P4 - Testing and Classification of Resistance Against Manual Attack.
 - f. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - g. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
 - h. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
 - i. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - PLASTIC FILM

- A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- B. Place without air bubbles, creases or visible distortion.
- C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.5 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.6 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 80 00

SECTION 088700 - SECURITY GLAZING FILMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glazing film applied to new glazing assemblies.

1.2 REFERENCE STANDARDS

- A. WEY-SA-C1 – Standard for shooter/attack certification and forced entry.
- B. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- C. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air Blast Loadings.
- D. UL972 – Standard for Burglary Resisting Glazing.
- E. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.
- F. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- G. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
- H. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- I. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a

1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Record of product certification for safety requirements.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- D. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.
- E. Specimen warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of security glazing films with minimum 10 years successful experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufactures unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent—based materials, in accordance with requirements of authorities having jurisdiction.

1.6 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

PART 2 PRODUCTS

2.1 MANUFACTURERS

- Y Armoured One LLC: www.ArmouredOne.com
1. Tactical Security Film 21MIL single layer Applied to Recommended Areas or Approved Equal.

2.2 SECURITY GLAZING FILM

- A Security Glazing Film: Retrofit existing glazing assemblies to provide impact resistance and forced/attack resistance complying with WEY-SA-C1, ANSI Z97. I and CPSC 16 CFR 1201 Category II, ASTM E330, UL972, EN356 P4A, and GSA Level C as specified:
1. Applied to 1/4-inch-thick clear annealed glass.
 2. Surface applied film.
 3. Provide supplemental anchoring system as required to meet forced entry resistance requirements.

2.3 MATERIALS

- K Glazing Film: Transparent polyester film for permanent bonding to glass.
1. Thickness: 0.021 inch, minimum. Must be a single layer film. Multi-layering film to achieve thickness is not acceptable.
 2. Color: Clear.
 3. Construction: 3-ply laminate.
 4. Adhesive Type: Pressure sensitive.
 5. Tensile Strength: 28,500 psi minimum.
 6. Breaking Strength: 615 lbs / inch.
 7. Elongation at Break: 230%
 8. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).
 9. Provide 12 Year manufacturers replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.
 10. Light Transmission of Film Applied on 1/4-inch-Thick Clear Annealed Glass:
 - a. Visible light Transmittance: 86 percent.
- A. Anchoring System: DOW 995 or GE SCS2000 SilPruf Structural Sealant with high impact styrene trim.

PART3 EXECUTION

3.1 EXAMINATION

- A. Field -Applied Film: Verify that existing conditions are adequate for proper application and performance of film.
- B. Examine glass and frames. *Send* that existing conditions are adequate for proper application and Performance of film.
- C. Verify glass is not cracked, chipped, broken, or damaged.
- D. Verify that frames are securely anchored and free of defects.

3.2 PREPARATION

- A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.
- C. Protect adjacent surfaces.
- D. Do not begin installation until substrates have been properly prepared.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.
- B. Accurately cut film with straight edges to required sizes allowing 1/16-inch to 1/8-inch gap at perimeter of glazed panel unless otherwise required by anchorage method.
- C. Seams. Seam film only as required to accommodate material sizes; seam without overlaps.
- D. Clean glass prior to film installation with neutral cleaning solution.
- E. Peel back release liner and apply film to glass. Using squeegees, push out solution between film and glass.
- F. Once film is installed, anchor the edges of the film by applying approved structural sealant and high impact styrene to the edges of the frames and film.
- G. Clean glass and excess structural sealants from finished surfaces
- H. Remove any labels or protective covers.

3.4 Film Verification

- a. Awarded contractor will be required to verify that film installed meets the requirements highlighted in this bid. By submitting a bid, you as the contractor understand that three pieces of glass, chosen at random will be removed and film applied will be measured to verify that film installed meets specifications as requested. Film may need to be removed as part of the verification process.

3.5 PROTECTION

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

END OF SECTION 088717

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

1.2 REFERENCE STANDARDS

- A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.
- H. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
- I. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.
- J. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.
- K. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- L. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- O. ASTM E413 - Classification for Rating Sound Insulation.
- P. GA-216 - Application and Finishing of Gypsum Panel Products.

1.3 SUBMITTALS

- A. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. STC-Rated Assemblies: Provide complete assemblies identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by and independent agency.

2.2 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum Company.
 - 2. CertainTeed Corporation.
 - 3. Georgia-Pacific Gypsum.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required as indicated on Drawings.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Abuse Resistant Wallboard:
 - 1. Application: High-traffic areas indicated.
 - 2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 6. Type: Fire resistance rated Type X, UL or WH listed.
 - 7. Thickness: 5/8 inch.
 - 8. Edges: Tapered.
- D. Impact Resistant Wallboard:
 - 1. Application: High-traffic areas indicated.
 - 2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 7. Type: Fire resistance rated Type X, UL or WH listed.
 - 8. Thickness: 5/8 inch.
 - 9. Edges: Tapered.
- E. Backing Board For Wet Areas: One of the following products:
 - 1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
3. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
- F. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Type: Regular and Type X, in locations indicated.
 3. Type X Thickness: 5/8 inch.
 4. Regular Board Thickness: 1/2 inch.
 5. Edges: Tapered.
- G. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch.
 3. Edges: Tapered.

2.3 Gypsum Wallboard ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 21 00.
- B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, and LC-bead at exposed panel edges.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Joint Compound: Setting type, field-mixed.
- D. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- G. Nails for Attachment to Wood Members: ASTM C514.
- H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.

3.3 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.4 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as indicated on drawings or as noted below where not indicated on drawings:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

END OF SECTION 09 21 16

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-structural metal partition, ceiling, and soffit framing.
- B. Non-structural Framing accessories.

1.2 REFERENCE STANDARDS

- A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
 - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories: Subject to compliance with requirements, provide products by one of the following:
 - 1. CEMCO .
 - 2. ClarkDietrich Building Systems .
 - 3. The Steel Network, Inc .
 - 4. MBA Building Supplies.
 - 5. MRI Steel Framing.
 - 6. Phillips Manufacturing Co..
 - 7. Telling Industries.

2.2 FRAMING MATERIALS

- A. Fire Rated Assemblies: Comply with applicable code and tested in accordance with ASTM E 119 by an independent testing agency.
- B. -----
- C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as indicated on Drawings.
 - 1. Studs: C shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
- D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
- E. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- F. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs{CH#58215}.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- G. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.
- H. Fasteners: ASTM C1002 self-piercing tapping screws.
- I. Acoustic Insulation: As specified in Section {CH#58222}.
- J. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
 - 1. Fire-Resistance Rating: 2 hours
 - 2. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - a. Depth: As indicated in Drawings.
 - 3. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2-inches long and matching studs in depth.
 - 4. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

2.3 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

- A. Extend partition framing to structure where indicated and to ceiling in other locations.
- B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- C. Align and secure top and bottom runners at 24 inches on center.
- D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- E. Install studs vertically at spacing indicated on drawings.
- F. Align stud web openings horizontally.
- G. Secure studs to tracks using fastener method. Do not weld.
- H. Stud splicing is not permissible.
- I. Fabricate corners using a minimum of three studs.
- J. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- K. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- L. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- M. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 09 22 16

SECTION 09 30 00 – TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile for wall applications.
- B. Non-ceramic trim.

1.2 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement.
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
- E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.
- J. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar.
- K. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- L. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar.
- M. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation.
- N. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation.
- O. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- Q. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- R. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.3 PRE-INSTALLATION MEETING

- A. Pre-Installation Meeting: Convene a pre-installation meeting at least one week before starting installation. All affected installers are required to attend.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Samples for Verification: Provide physical samples of each product to be installed covering each type, color, and texture.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- B. Extra Materials (Attic Stock): Furnish the following for Owner's future use for maintenance.
 - 1. Extra Tile: 10 square feet minimum of each size, color, and surface finish combination.
 - 2. Tile Trim and Trim Units: Furnish at least 10 linear feet or 3 percent of installed trim , whichever is greater, of full-size units for each type, composition, color, pattern, and size indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.7 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE

- A. Porcelain Tile ANSI A137.1 standard grade.
 - 1. Size: As indicated on Drawings.
 - 2. Color(s): As indicated on drawings.
 - 3. Pattern: As indicated on Drawings..
 - 4. Products: Subject to compliance with requirements, provide basis-of-design product as indicated on Drawings or equivalent product by one of the following:
 - a. American Olean Corporation.
 - b. Crossville Inc.
 - c. Dal-Tile Corporation.
 - d. Emser Tile, LLC.
 - e. Shaw Industries Group, Inc. a Berkshire Hathaway Company.
 - f. United Tile.
 - g. Wasau Tile Inc.

2.2 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Schluter-Systems.
 - b. Genesis APS International.

2.3 SETTING MATERIALS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. ARDEX Engineered Cements.
 - 2. Bostik Inc.
 - 3. Custom Building Products.
 - 4. LATICRETE International, Inc.

- B. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.

2.4 GROUTS

- A. Standard Grout: ANSI A118.6 standard cement grout.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 3. Color(s): As indicated on drawings.
 4. Products: Subject to compliance with requirements provide products by one of the following:
 - a. Custom Building Products.
 - b. LATICRETE International, Inc.
 - c. Mapei Corporation.
- B. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
1. Applications: All grout applications.
- 2.5 Maintenance Materials**
- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
 2. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Engineered Cements.
 - b. Custom Building Products.
 - c. LATICRETE International, Inc .
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
- 2.6 ACCESSORY MATERIALS**
- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Type: Fluid-applied.
 2. Thickness: 20 mils, maximum.
 3. Crack Resistance: No failure at 1/16 inch gap, minimum.
 4. Products: Subject to compliance with requirements provide products by one of the following:
 - a. LATICRETE International, Inc.
 - b. Merkrete, by Parex USA, Inc.
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products: Subject to compliance with requirements, provide products by one of the following:
 - 1) ARDEX Engineered Cements.
 - 2) Custom Building Products.
 - 3) TEC, an H.B. Fuller Construction Products Brand.
 - 4) LATICRETE International, Inc .

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
 - 1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
 - 2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.
- E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- C. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- G. Form internal angles square and external angles bullnosed.
- H. Install non-ceramic trim in accordance with manufacturer's instructions.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 CLEANING

- A. Clean tile and grout surfaces.

3.5 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

3.6 SCHEDULE

- A. Interior Wall and Floor Installations, Wood or Metal Studs or Furring:
 - 1. ANSI A108.1A is wet-set method, ANSI A108.1B is cured-bed method, and ANSI A108.1C allows Contractor choice of using either method.
 - 2. Ceramic Tile Installation: TCNA W243; thinset mortar on gypsum board.
 - a. Ceramic Tile Type: As indicated on Drawings.
 - b. Thinset Mortar: Modified dry-set mortar.
 - c. Grout: Standard sanded cement grout.

END OF SECTION 09 30 00

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling systems.
- B. Acoustical units.

1.2 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is complete and the area of construction is dry.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate grid layout and related dimensioning. The following items shall be shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical tile.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers
 - e. Sprinklers.
 - f. Access Panels.
 - g. Perimeter moldings.
 - 7. Show operation of hinged and sliding components adjacent to acoustical tiles.
 - 8. Minimum Drawing Scale: 1/4 inch = 1 foot. 1/8 inch = 1 foot.
- B. Product Data: Provide data on suspension system components.
- C. Samples for Verification: Submit two samples minimum 6" by 6" inch in size illustrating material and finish of acoustical units.
- D. Product Testing Reports: For each acoustical tile ceiling, for tests performed by [manufacturer and witnessed by a qualified testing agency], [a qualified testing agency].

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.
- C. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
 - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
- B. Performance Requirements:
 - 1. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 2. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL or from the listings of another qualified testing agency.
- C. Acoustic Tiles/Panels: As indicated on Drawings.
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. USG.
- D. Suspension Systems:
 - 1. Metal Suspension-System, Standard, Ceiling : Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.
 - a. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

2.2 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

2.3 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung" unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - 3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- D. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with seismic design requirements, ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required [and, if permitted with fire-resistance-rated ceilings,] to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
 - 1. As indicated on reflected ceiling plans.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
 - 1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
 - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
 - 3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.
- H. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- I. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- J. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- K. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- L. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- M. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- N. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

3.5 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.6 ADJUSTING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.2 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.3 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Wall Base: 10 linear feet of each type and color, or 10%, whichever is greater.
- H. Closeout Submittals: Maintenance Data.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.

1.5 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

3.1 RESILIENT BASE

- A. Resilient Base - Type: as noted on Finish Plan.
 - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 - 2. Height: As indicated on Drawings.
 - 3. Color: As indicated on drawings.
 - 4. Accessories: Premolded external corners and internal corners, or job formed.

PART 3 EXECUTION

4.1 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
 - 1. Test in accordance with ASTM F710.
 - 2. Moisture Testing: Performance test so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)] in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum [75] percent relative humidity level measurement.
 - 3. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - a. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
 - 4. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.
- D. Verify that required floor-mounted utilities are in correct location.

4.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

4.3 Installation - General

- A. Install in accordance with manufacturer's written instructions.
- B. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- C. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- E. Retain first paragraph below for floor tile installed on floor covers.
- F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Revise first paragraph below if other-than-full-spread adhesive method is recommended by manufacturer for substrate and tile products.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Before retaining "Floor Polish" Paragraph below, verify manufacturer's written instructions for floor polish. Floor polish is used with most vinyl composition floor tile and some solid vinyl floor tile.
- J. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

4.4 Installation - Resilient Base

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

4.5 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

4.6 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 91 13 – EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles, steel bollards.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications .
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual .

1.05 SUBMITTALS

- A. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

1. Where sheen is specified, submit samples in only that sheen.
 - C. Manufacturer's Instructions: Indicate special surface preparation procedures.
 - D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces and color samples of each color and finish used.
 - E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 2. Label each container with color in addition to the manufacturer's label.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
 - B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
 - C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.
- 1.07 FIELD CONDITIONS
- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
 - B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
 - C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
 - D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
 - E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

- 2.01 MANUFACTURERS
- A. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for exterior, unless required otherwise by manufacturer's instructions.
 - B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
 3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Paints:
 - 1. Behr Process Corporation; <>
 - 2. Dow Corning Corporation
 - 3. PPG Paints; <>
 - 4. Sherwin-Williams Company; <>
- D. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated in Color Schedule.
 - 1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to Architect.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - MPI SYSTEMS

- A. Substrate: Steel Fabrications, Exterior .
 - 1. MPI System: EXT 5.1D.
 - 2. Primer: Alkyd Primer; MPI # 79.
 - 3. Intermediate Coat: Alkyd; MPI # 94.
 - 4. Top Coat: Alkyd; MPI # 94.
 - 5. Sheen: Gloss Level 5.
- B. Substrate: Galvanized Metal, Exterior .
 - 1. MPI System: EXT 5.3L.
 - 2. Primer: Epoxy Primer; MPI # 101.
 - 3. Intermediate Coat: Polyurethane; MPI # 72.
 - 4. Top Coat: Polyurethane; MPI # 72.
 - 5. Sheen: Gloss Level 6.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.2 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.3 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- E. SSPC-SP 1 - Solvent Cleaning.
- F. SSPC-SP 6 - Commercial Blast Cleaning.

1.4 SUBMITTALS

- A. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- B. Samples for Verification: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed by Owner.

2. Label each container with color matching identification on drawings in addition to the manufacturer's label.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Minimum Application Temperature for {CH#191689} Finishes: {CH#191690} for interior, unless required otherwise by manufacturer's instructions.
- B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
- C. Paints:
 1. -----
 2. -----
 3. Behr Process Corporation.
 4. PPG Paints.
 5. Sherwin-Williams Company.
- D. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.

1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Clean concrete according to ASTM D4258. Allow to dry.
- F. Masonry:
 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces:
- I. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - MPI PAINT SYSTEMS

- A. Substrate: Concrete Vertical Surfaces, Interior .
 - 1. MPI System: 3.1C.
 - 2. Primer: Alkali Resistant Water Based Primer; MPI # 3.
 - 3. Intermediate Coat: HIPAC Latex; MPI # 139.
 - 4. Top Coat: HIPAC Latex; MPI # 139.
 - a. Sheen: Gloss Level 3
- B. Substrate: Concrete Horizontal Surfaces, Interior .
 - 1. MPI System: 3.2B.
 - 2. Primer: Alkyd Floor Enamel; MPI # 27.
 - 3. Intermediate Coat: Alkyd Floor Enamel; MPI # 27.
 - 4. Top Coat: Alkyd Floor Enamel; MPI # 27.
 - a. Sheen: Gloss Level 6
- C. Substrate: Gypsum Board, Interior .
 - 1. MPI System: 9.2M.
 - 2. Primer: Primer/Sealer, Low Odor/Low VOC; MPI # 149.
 - 3. Intermediate Coat: Institutional Low Odor/Low VOC; MPI # 145.
 - 4. Top Coat: Institutional Low Odor/Low VOC; MPI # 145.
 - a. Sheen: Gloss Level 3
- D. Substrate: Wood, Dimensional Lumber, Interior .
 - 1. MPI System: 6.2B.
 - 2. Primer: Alkyd Primer/Sealer; MPI # 45.
 - 3. Intermediate Coat: HIPAC Latex; MPI # 139.
 - 4. Top Coat: HIPAC Latex; MPI # 139.
 - a. Sheen: Gloss Level 3
- E. Substrate: Steel Doors and Frames, Interior .
 - 1. MPI System: 5.3M.
 - 2. Primer: Water Based Galvanized Primer; MPI # 134.
 - 3. Intermediate Coat: HIPAC Latex; MPI # 139.
 - 4. Top Coat: HIPAC Latex; MPI # 139.
 - a. Sheen: Gloss Level 3
- F. Substrate: Structural Steel and Metal Fabrications, Interior .
 - 1. MPI System: 5.1S.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Primer: Rust Inhibitive Water Based Primer; MPI # 107.
3. Intermediate Coat: Rust Inhibitive Water Based Primer; MPI # 107.
4. Intermediate Coat: [Institutional Low Odor/Low VOC]; MPI #[145].
5. Top Coat: Institutional Low Odor/Low VOC; MPI # 145.
 - a. Sheen: Gloss Level 3

END OF SECTION

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Markerboards.
- B. Tackable Wallcovering.

1.2 SUBMITTALS

- A. Product Data: Provide manufacturer's data on markerboards and tackable wall covering.
- B. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- C. Samples: Submit color charts for selection of color and texture of markerboards and tackable wall covering.

1.3 CLOSEOUT SUBMITTALS

- A. Owner's Manuals and Maintenance Data: Include data on regular cleaning, and stain removal.
- B. Manufacturer Warranty Form.

1.4 WARRANTY

- A. Markerboard Manufacturer's Warranty: Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.
- B. Tackable Wall Covering Manufacturer's Warranty: Provide five year warrant for tackable wall coverings to include warranty against manufacturing defects.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY BOARDS

- A. Markerboards: Glass.
 - 1. Products: Basis-of-Design: Subject to compliance with requirements provide MooreCo Inc., Visionary Magnetic Glass Board or an equivalent product by one of the following:
 - a. Claridge Products & Equipment, Inc..
 - b. PolyVision Corporation.
 - 2. Color: As indicated on drawings.
 - 3. Size: As indicated on drawings.
 - 4. Frame: As indicated on drawings.
- B. Tackable Wall Coverings
 - 1. Products, Basis-of-Design: Subject to compliance with specifications, provide Claridge Products and Equipment, Fabric wrapped Carnegie Xorel approved equal.
 - 2. Adhesive: Manufacturer's standard adhesive for substrate.
 - 3. Color: To be selected from manufacturer's full range.
 - 4. Size: As indicated on Drawings.
 - 5. Frame: Clear satin, anodized aluminum J-Trim.
 - a. Size: 1/4 inch.

2.2 ACCESSORIES

- A. Markerboard Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- B. Markerboard Accessory Tray: Aluminum, manufacturer's standard profile, molded ends, concealed fasteners, same finish as frame.
- C. Markerboard Mounting Brackets: Concealed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements match those indicated in the Drawings and as identified in the shop drawings.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings. If necessary internal wall blocking is not present, notify the Contractor in writing. Do not install visual display boards unless necessary wall blocking is installed.
- C. Examine areas and conditions in which visual display boards will be installed.
- D. Complete finishing operations, including painting, before beginning installation of visual display boards.
- E. Examine wall surfaces to receive visual display boards and verify that they are dry and free from dirt, grease, loose paint, and scale.
- F. Notify the Contractor in writing if any conditions detrimental to the proper completion of the installation are present. Do not install visual display boards unless the wall surface if any conditions detrimental to the proper completion of the installation are present.
- G. Installation of visual display boards means acceptance of substrate and wall surface conditions by the Contractor. After acceptance of the substrate and wall surface conditions by the Contractor, additional costs for correction of substrate and wall surface conditions, un-installation, and re-installation costs are to be borne by the Contractor.

3.2 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.
- C. Butt Joints: Install with tight hairline joints.

3.3 CLEANING

- A. Clean wall surfaces in accordance with manufacturer's instructions.
- B. Following Manufacturer requirements and recommendations, cover visual display boards with a temporary protective cover.
- C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION 10 11 00

SECTION 10 14 00 – SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Panel signs.

1.2 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. Submit for approval by Owner through Architect prior to fabrication.
- C. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.4 CLOSEOUT SUBMITTALS

- A. Owner's Manual and Maintenance Data.
- B. Manufacturer's Warranty Form.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signage that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.2 MANUFACTURERS

- A. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
 - 1. Best Sign Systems, Inc .
 - 2. Cosco Industries (ADA signs) .
 - 3. Inpro .
 - 4. Seton Identification Products .
 - 5. Signs & Decal Corp.
 - 6. Vista System.

2.3 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

2.4 SIGN TYPES

- A. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Character Color: Contrasting color to panel color complying with ADA and ANSI A117.1.

2.5 PANEL SIGNS

- A. Panel Sign as indicated on Drawings: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
- B. Solid-Sheet Sign
 - 1. Material: Acrylic or PVC sheet.
 - 2. Thickness: Manufacturer's standard for size of sign.
 - 3. Surface-Applied, Flat Graphics: Applied vinyl film.
 - 4. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
- C. Sign-Panel Perimeter: Finish edges smooth.
- D. Mounting: Manufacturer's standard method for substrates indicated, surface mounted to wall with concealed anchors, adhesive, or two face tape.
- E. Surface Finish and Applied Graphics:
 - 1. Integral Acrylic or PVC.
 - 2. Sheet Color: As selected by Architect from full range of standard colors.

2.6 PANEL SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.7 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Pre-assemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
- B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.
 - 1. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
 - 2. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.9 ACCESSORIES

- A. Adhesive: As recommended by sign manufacturer.
- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify that electrical service is correctly sized and located to accommodate signs.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

- b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 3. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of signage and of suitable quantity to support weight of signage after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as signage is applied and to prevent visibility of cured adhesive at signage edges. Place signage in position, and push to engage adhesive. Temporarily support signage in position until adhesive fully sets.
 6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 7. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using [method specified above] .
 - C. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
 - D. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
 - E. Protect from damage until Substantial Completion; repair or replace damaged items.
- 3.3 ADJUSTING AND CLEANING**
- A. Remove and replace damaged or deformed signs and plaques that do not comply with specified requirements. Replace signage with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
 - B. Remove temporary protective coverings and strippable films as signs are installed.
 - C. Upon completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

2.2 CORNER GUARDS

- A. Surface-Mounted, Stainless Steel Corner Guards: Manufacturer's standard assembly consisting of full height guard including mounting adhesive and fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Finish: #4 Satin

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Wing Length: 2 inches
3. Finished Length: 4'-0" high.

2.3 MATERIALS

- A. Adhesive: As recommended by protection product manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 1. Provide anchoring devices and suitable locations to withstand imposed loads.

END OF SECTION 102600

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Electric hand dryers.

1.2 RELATED REQUIREMENTS

- A. Refer to plumbing drawings and specifications for under-lavatory pipe and supply covers.
- B. Refer to plumbing drawings and specifications for shower, tub, and bath accessories.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM C1036 - Standard Specification for Flat Glass.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

- A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.6 CLOSEOUT SUBMITTALS

- A. Owner's Manuals and Maintenance Data

PART 2 PRODUCTS

2.1 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide two (2) keys for each accessory using a keyed device to Architect.
- C. Stainless Steel Sheet: Type 304.
- D. Mirror Glass: Annealed float glass, Type I, Class 1, Quality Q2, with silvering.
- E. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.2 Commercial Toilet Accessories

- A. Mirrors: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective.
 - 2. Size: 24" x 30".
 - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-165 2430 or comparable product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- d. Gamco
 - B. Grab Bars: Satin stainless steel, nonslip grasping surface finish.
 - 1. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - 2. Length and Configuration: 18", 36", and 42" as indicated on drawings and located complying with ADA requirements.
 - 3. Basis-of-Design: Subject to compliance with requirements, provide Bobrick Model 5806 Series grab bars or product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco USA
 - C. Combination Sanitary Napkin/Tampon Dispenser: Satin Stainless steel, surface-mounted.
 - 1. Door: Seamless 0.05 inch door with returned edges and tumbler lock.
 - 2. Cabinet: Fully welded, 0.03 inch thick sheet.
 - 3. Identify dispensers slots without using brand names.
 - 4. Minimum capacity: 20 napkins and 20 tampons.
 - 5. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-2706 or comparable product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco USA
 - D. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-254 sanitary napkin disposal of comparable product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco USA
- 2.3 Electric Hand/Hair Dryers**
- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
 - 1. Operation: Automatic, sensor-operated on and off.
 - 2. Mounting: Surface mounted.
 - 3. ----- Fastest Drying, Most Control -----
 - 4. ----- Lowest Energy Usage -----
 - 5. Air Velocity: 15,000 linear feet per minute, minimum.
 - 6. Fan Control: Field adjustable down to approximately half-speed.
 - 7. Total Wattage: 500 W, maximum; no heater.
 - 8. Runtime: Field adjustable, from approximately 10 seconds to approximately 35 seconds.
 - 9. ----- Lowest Cost, Least Airflow -----
 - 10. -----

PART 3 EXECUTION

3.1 EXAMINATION

- A. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Verify that field measurements are as indicated on drawings.
- C. Verify that blocking is ready to receive work and positioning dimensions are as indicated on Drawings and shop drawings. If necessary blocking is not present, notify the Contractor in writing. Do not install restroom accessories unless necessary wall blocking is installed.

3.2 PREPARATION

- A. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations and as indicated on drawings.

3.4 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.2 SUBMITTALS

- A. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions for each type of product.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Owner's Manual and Maintenance Data.

1.4 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business .
 - 2. Kidde, a unit of United Technologies Corp .
 - 3. Nystrom, Inc .
 - 4. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 5. Larsens Manufacturing Company.
 - 6. Guardian Fire Equipment, Inc.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group .
 - 2. Ansul, a Tyco Business .
 - 3. Kidde, a unit of United Technologies Corp .
 - 4. Larsen's Manufacturing Co .
 - 5. Nystrom, Inc .
 - 6. Guardian Fire Equipment, Inc..

2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; MP10 or comparable product by one of the manufacturers listed above.
 - 2. Class: A:B:C type.
 - 3. Size: 10 pound.
 - 4. Finish: Baked polyester powder coat, red color.
 - 5. Mounting: As indicated in drawings.

- a. Provide manufacturer standard wall bracket where bracket mount is indicated in drawings.

2.3 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
- C. Cabinet Configuration: Semi-recessed type with multipurpose dry chemical fire extinguisher.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R7 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 - 2. Size to accommodate accessories.
 - 3. Trim: Square edge.
 - 4. Trim and Door Material: Steel sheet.
 - 5. Door Glazing: Clear transparent acrylic sheet.
 - 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 60 inches from finished floor to top of cabinet, confirm height acceptable to authorities having jurisdiction.
- C. Secure rigidly in place.

END OF SECTION 10 44 00

SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Window shades and accessories.

1.2 REFERENCE STANDARDS

- A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- B. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- C. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- B. Manufacturer's Warranty Form: Submit manufacturer's warranty and documentation of final executed warranty completed in Architect's name and registered with manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.7 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.
 - 3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Manually Operated Roller Shades:
 - a. Draper, Inc.
 - b. Lutron Electronics Co., Inc .
 - c. Hunter Douglas Architectural .
 - d. TimberBlindMetroShade .
 - e. SWFcontract, a division of Springs Window Fashions, LLC.
- B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 WINDOW SHADE APPLICATIONS

- A. Interior Roller Shades: Sheer shades.

1. Type: Roll down, closed position is at window sill.
2. Fabric: 1% openness factor..
3. Color: Manufacturer's standard grey..
4. Mounting: Inside (between jambs).

2.3 ROLLER SHADES

- A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
 1. Size: Fitting windows designated as receiving window shades as identified in drawings..
- B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 1. Sheer Shades: Reduce glare yet still reveal considerable details to the outside; no privacy; Openness Factor greater than 1 percent.
 2. Flammability: Pass NFPA 701 large and small tests.
- C. Roller Tubes: As required for type of operation.
 1. Material: Extruded aluminum or galvanized steel; as required for shade location.
 2. Size: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.
 3. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
 4. Finish: Clear anodized.
- D. Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
- E. Manual Operation for Interior Shades: Clutch operated continuous loop; beaded ball chain.

2.4 ACCESSORIES

- A. Fascias: Size as required to conceal shade mounting.
 1. Style: As selected by Architect from shade manufacturer's full selection.
 2. Material and Color: To match shade.
- B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.
- C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.5 FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Fabricate shades to fit openings within specified tolerances.
 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Installation Tolerances:
 - 1. Maximum Offset From Level: 1/16 inch.
- C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.5 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 12 24 00

SECTION 12 32 00 - MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufactured custom casework, with cabinet hardware.

1.2 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.3 REFERENCE STANDARDS

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware.

1.4 SUBMITTALS

- A. Produce Data: Provide data for hardware and accessories.
- B. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.
- C. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches.
 - 1. Plastic laminate samples, for color, texture, and finish selection.
 - 2. Thermally fused laminate samples, for color, texture, and finish selection.
- D. Manufacturer's Installation Instructions.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- B. Finish touch-up kit for each type and color of materials provided.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
 - 1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.7 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained finish coating.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Discoloration or lack of finish integrity.
3. Cracking or peeling of finish.
4. Delamination of components.
5. Failure of adhesives.
6. Failure of hardware.

PART 2 PRODUCTS

2.1 CASEWORK, GENERAL

- A. Plastic Laminate Faced Cabinets: Custom Grade.

2.2 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Glazing for Doors: Clear tempered glass.
 1. Glazing: With gaskets and removable stops; minimize rattling and vibration.
- D. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- E. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- F. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
- G. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- H. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- I. Apron Frames: Construction similar to other cabinets, with modifications.
 1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.
- J. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

2.3 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 3. Products: Subject to compliance with requirements provide products from one of the following:
 - a. Formica Corporation.
 - b. Panolam Industries International, Inc.
 - c. Wilsonart.
 4. Application: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
 - a. Surface Color and Pattern: As indicated on drawings.
 5. Exposed Interior Surface: Finish with thermally fused melamine.

- a. Color: White.

2.4 CABINET HARDWARE

- A. Comply with BHMA A156.9 requirements.
 - 1. Acceptable base materials for plated finishes include steel.
- B. Label Holders: Manufacturer's standard, sized to hold standard label cards, bright chromium plated over nickel on base material.
 - 1. Attachments: Wood screws, with finish matching label holders.
- C. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
 - 1. Hinged Doors: Cam type lock, bright chromium plated over nickel on base material.
 - 2. Tall Hinged Doors: Three-point latching system.
 - 3. Keying: Key locks alike within a space; key each room separately.
 - 4. Master Key System: All locks operable by master key.
- D. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- E. Swinging Doors: Hinges, pulls, and catches.
 - 1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
 - a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
 - 1) European-Style Hinges for Overlay Doors: 110 degree opening angle.
 - 2. Pulls: Chrome wire pulls, 4 inches wide.
 - 3. Catches: Magnetic.
- F. Drawers: Pulls and slides.
 - 1. Pulls: Chrome wire pulls, 4 inches wide.
 - 2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.5 MATERIALS

- A. Wood-Based Materials:
 - 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
 - 2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.
- B. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
- C. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.
- D. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

2.6 ACCESSORIES

- A. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As shown on drawings.
- B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- C. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.
- D. Sealant for Use in Casework Installation:

1. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

2.7 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline and secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints a minimum of 2 feet from sink cut-outs.
 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- D. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.1 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.2 EXAMINATION

- A. Site Verification of Environmental Conditions:
 1. Do not deliver casework until the following conditions have been met:
 - a. Building has been enclosed (windows and doors sealed and weather-tight).
 - b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
 - c. Ceiling, overhead ductwork, piping, and lighting have been installed.
 - d. Installation areas do not require further "wet work" construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. Verify adequacy of support framing and anchors.
- D. Verify that service connections are correctly located and of proper characteristics.

3.3 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- G. Install hardware uniformly and precisely.
- H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- I. Replace units that are damaged, including those that have damaged finishes.
- 3.4 ADJUSTING**
- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.
- 3.5 CLEANING**
- A. Clean casework and other installed surfaces thoroughly.
- 3.6 PROTECTION**
- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION 12 32 00

SECTION 12 36 00 – COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Countertops for manufactured casework.

1.2 REFERENCE STANDARDS

- A. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.
- B. NEMA LD 3 - High-Pressure Decorative Laminates.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- D. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

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

END OF SECTION 12 36 00

SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Insulated Metal wall and roof panels including soffits, gutters and downspouts and roof mounted equipment curbs.

1.02 SCOPE

- A. ***Design Criteria: The work includes a metal building system which may require deviations from the manufacturer's standard configurations. The drawings indicate (sizes, profiles, and dimensional requirements) of the pre-engineered metal building system. The design criteria, load limits, and other requirements may not be deviated from without written approval from the Architect. Metal buildings systems conforming to all performance characteristics without deviations, may be considered. Any deviations that may result in changes or additional costs, including all Architectural and Engineering services to review and remedy such deviations, shall be the full responsibility of the Sub-Contractor providing the metal building system.***

- 1. Some of the special requirements are as follows (See Structural and Architectural Drawings):
 - a. Column locations and spacing.
 - b. Bracing location and type.
 - c. Connections for structural components by other suppliers.
 - d. Additional loading.
 - e. Maximum load limits on foundations.
 - f. Supply anchor bolts.
 - g. Additional framing and loads to support mechanical equipment.
 - h. Collateral roof loading of misc. equipment as indicated in Structural Drawings.
 - i. Girt locations as shown.
 - j. Gutter and eave details.
 - k. Building Stiffness as indicated in Structural Drawings.
 - l. Meet uplift as indicated in Structural Drawings.
 - m. Curtainwall Attachment, if required. Coordinate with Curtainwall manufacturer for requirements.
 - n. Coordinate building design with existing pre-engineered metal building to remain. Shop drawings provided FOR REFERENCE ONLY in Appendix B.
- 2. If the manufacturer discovers any of the criteria to be in conflict with any other criteria and/or considers any criteria to be prohibitively expensive, the Sub-Contractor is obligated to inform the Architect prior to bid opening so that a formal interpretation or change by be issued in writing. Unless there is a formal modification to the Contract, all requirements shall be fulfilled at no additional cost to the Owner/Design Team.

1.03 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between accessory components and wall system.
- B. Section 08 11 13 - Hollow Metal Doors and Frames.
- C. Section 08 36 13 - Sectional Doors.
- D. Section 08 43 13 Aluminum Framed Storefronts
- E. Section 08 44 13 Aluminum Framed Curtain Walls
- F. FOR REFERENCE ONLY Existing PEMB Shop Drawings in Appendix B.

1.04 PRE-INSTALLATION MEETING

- A. Pre-installation Meeting: Convene one week before starting work of this section.
 - 1. Post meeting record to project website.

1.05 SUBMITTALS

- A. Product Data: Provide data on profiles, component dimensions, fasteners.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, {CH#241860}; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.
- C. Samples: Submit one (1) sample of precoated metal panel for each color and type selected, 12by12 inch in size illustrating color and texture of finish product.
- D. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
- F. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.

8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

G. Sample Manufacturer's Warranty form.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Warranty form.

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
 1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
 2. Comply with applicable code for submission of design calculations as required for acquiring permits.
 3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.
- B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
 1. Not less than 5 years of documented experience.
 2. Accredited by IAS in accordance with IAS AC472.
- C. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.08 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide 20 year manufacturer warranty for Weathertightness for Standing-Seam Metal Roof Panels and Metal Panel Finishes.
 1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. A&S Building Systems, Inc.

2. Alliance Steel, Inc.
3. American Buildings Company, a Nucor Company.
4. American Steel Building Co., Inc.
5. Behlen Manufacturing Co.
6. Butler Manufacturing Company.
7. CBC Steel Buildings; a Division of Magnatrax Corp.
8. Ceco Building Systems.
9. Chief Buildings.
10. Elite Structures, Inc.
11. Gulf State Manufacturers, Inc.; a Division of Magnatrax Corp.
12. Inland Building Systems.
13. Kirby Building Systems.
14. Mesco Building Solutions; a Division of NCI Building Systems, L.P.
15. Metallic Building Company.
16. Metco Metal Supply.
17. Mid-West Steel Building Company; a Division of NCI Building Systems, L.P.
18. Nucor Building Systems.
19. Olympia Steel Building Systems.
20. Pinnacle Structures, Inc.
21. Red Dot Buildings.
22. Star Building Systems; an NCI company.
23. USA, Inc.
24. Vulcan Steel Structures, Inc.
25. VP Buildings.
26. Substitutions: See Section 01 25 00 Substitution Procedures.

2.02 ASSEMBLIES

- A. Tapered beam.
- B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, intermediate columns and end wall columns, and wind bracing.
- C. Secondary Framing: Purlins, Girts and Eave struts, and other items detailed.
- D. Wall System: Pre-formed metal panels of vertical profile, with sub-girt framing/anchorage assembly and insulation, and accessory components.
- E. Roof System: Pre-formed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly and insulation, and accessory components.

2.03 PERFORMANCE REQUIREMENTS

- A. Refer to Drawings for structural design criteria.
- B. Installed Thermal Resistance of Wall System: R-value of 13 (RSI-value of [____]).
- C. Installed Thermal Resistance of Roof System: R-value of 19 (RSI-value of [____]).
- D. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. If retaining option in "Performance Requirements" subparagraph below, indicate minimum live, dead, snow, collateral, seismic, wind, and uplift loads and load combinations on Drawings as applicable.
 - 2. Design Loads: As indicated on Drawings.
 - 3. Retain one of two "Deflection and Drive Limit" subparagraphs below, if required.
 - 4. Deflection and Drift Limits: Design metal building systems assemblies to withstand serviceable design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceable Design Considerations for Steel Buildings."
 - 5. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/120 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/120 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Metal Building System shall be designed to meet a horizontal drift requirement not to exceed H/240 based on service level wind loads.
 - 6. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 7. 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.
 - a. Ambient Temperature Change: 120 degrees Fahrenheit.
 - b. Material Surfaces Temperature Change: 180 degrees Fahrenheit.
 - 8. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592 for wind loads as indicated on drawings.
 - 9. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at 1.58 lbf/sq. ft. (75 Pa.).
 - 10. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at 2.86 lbf./sq. ft. (137 Pa.).

11. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at 2.86 lbf./sq. ft. (137 Pa.).
12. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
13. Design structural members to withstand Class 60 wind uplift in accordance with UL 580.
14. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

2.04 **MATERIALS - WALLS AND ROOF**

- A. Steel Sheet: ASTM A792/A792M aluminum-zinc alloy coated to AZ50/AZM150.
- B. Insulation: Batt glass fiber type, faced with reinforced grey vinyl to match paint color PT3 (light grey), ASTM E84 Class A, flame spread index of 25 or less where exposed, friction fit, 2 inches thick.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.
- E. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.
- F. Roof Curbs: Insulated metal same as roofing, [1 1/2"] inch ([_____] mm) thick, designed for imposed equipment loads, anchor fasteners to equipment, counterflashed to metal roof system.
- G. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.05 **FABRICATION - FRAMING**

- A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.
- B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.
- C. Provide wall opening framing for doors, windows, and other accessory components.

2.06 **FABRICATION - WALL AND ROOF PANELS**

- A. Wall and Roof Panels to match existing panels to remain.
 1. Blue = Berridge Award Blue Vee-Panel, ***no exceptions***.
 2. Gray = Match existing panel color on UTC construction.
- B. Roofing: Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with interlocking ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.

2. Clips: One-piece fixed to accommodate thermal movement.
3. Joint Type: Mechanically seamed.
4. Panel Coverage: 16 inches (406 mm).
5. Panel Height: 2 inches (51 mm).
6. Basis of Design: MBCI BattenLok HS
- C. Siding: Concealed-Fastener, Metal Wall Panels: Basis of Design is MBCI The Designer Series 16.0 Fluted.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Panel Coverage: 16 inches.
 3. Panel Height: 1 3/4".
- D. Soffit: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
 1. Metal Soffit Panels: Basis of Design MBCI Artisan Series L12 with Beads.
 - a. Finish: Match finish and color of metal roof panels.
- E. Interior Metal Wall & Liner Panel: Minimum [0.024] inch metal thickness, PBU profile indicated, 3/4" inch deep, lapped edges fitted with continuous gaskets.
- F. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- G. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with thick sheet.
- H. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- I. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.07 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Fabricate of same material and finish as roofing metal.
- B. Form gutters and downspouts and scuppers of Box Gutter profile and size indicated to collect and remove water. Fabricate with connection pieces.
- C. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- D. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.08 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners.
- G. Install insulation and vapor retarder utilizing metal panel fastened to framing for attachment.
- H. Install sealant and gaskets, providing weather tight installation.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Apply bituminous paint on surfaces in contact with cementitious materials.
- C. Connect downspouts to storm sewer system.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.
- B. Siding and Roofing: 1/8 inch (3 mm) from true position.

END OF SECTION

SECTION 21 05 00
BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 21 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Extend and modify existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - c. Furnish and install water heaters.
 - d. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
 - e. Extend and modify existing sanitary sewer and vent system.
 - f. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 22 05 50.
 - 2. Heating Work shall include, but is not necessarily limited to:
 - a. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
 - b. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
 - c. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install modular indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install all terminal air boxes and reheat coils.
 - f. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - g. Extend and modify existing temperature control systems.
 - h. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
4. Temperature Control Work shall include, but is not necessarily limited to:
 - a. Extend and modify existing temperature control system as specified in Section 23 09 00 to serve new equipment.
 - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
 - c. Furnish automatic control dampers for installation by others.
 - d. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
 - e. This Contractor shall install all devices so noted in Section 23 09 00.
5. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Extend and modify existing wet pipe sprinkler system for areas noted on the drawings.
 - b. Furnish and install all items listed on the Fire Protection Material List.
 - c. Furnish all hydraulic calculations and working sprinkler drawings.
 - d. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 21 05 50.
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Condensing Units.
 - b. Makeup Air Units.
 - c. Modular Air Handling Units.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
 - 4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
 - 1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
 - 2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
 - 3. Provides motor control and temperature control wiring, where so noted on the drawings.
 - 4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
 - 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

- A. Definitions:
 - 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
 - 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
 - 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 - 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 - 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
 - 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1.) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2.) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3.) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4.) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5.) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
 - 2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Linn, Missouri Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of Linn-State Technical College.
3. Conform to all State Codes.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for water service connection.
- F. Examination of Drawings:
1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
 7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
 8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.
- G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
- H. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
21 05 00	Owner Training Agenda
21 05 50	Seismic Restraint Systems
21 13 00	Sprinkler Systems
21 13 00	Fire Protection Equipment
21 30 00	Fire Pumps

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- Date
- Project title and number
- Contractor's name and address
- Division of work (e.g., plumbing, heating, ventilating, etc.)
- Description of items submitted and relevant specification number
- Notations of deviations from the contract documents
- Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- Date
- Project title and number
- Architect/Engineer
- Contractor and subcontractors' names and addresses
- Supplier and manufacturer's names and addresses
- Division of work (e.g., plumbing, heating, ventilating, etc.)
- Description of item submitted (using project nomenclature) and relevant specification number
- Notations of deviations from the contract documents
- Other pertinent data
- Provide space for Contractor's review stamps

3. Composition:

- Submittals shall be submitted using specification sections and the project nomenclature for each item.
- Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- All sets shall contain an index of the items enclosed with a general topic description on the cover.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1.) Only approved manufacturers are used.
 - 2.) Addenda items have been incorporated.
 - 3.) Catalog numbers and options match those specified.
 - 4.) Performance data matches that specified.
 - 5.) Electrical characteristics and loads match those specified.
 - 6.) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7.) Dimensions and service clearances are suitable for the intended location.
 - 8.) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9.) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- d. All marks and identifications on the submittals shall be unambiguous.
 - 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 - 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - 9. Reproduction of contract documents alone is not acceptable for submittals.
 - 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 - 11. Submittals not required by the contract documents may be returned without review.
 - 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 - 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 - 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
- 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 21 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 21 XX XX.description.YYYYMMDD
 - 5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.7 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.
- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- B. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.13 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.14 CONTINGENCY

- A. The Fire Protection Contractor shall include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Protect excavations against frost and freezing.
 5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
 6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
 8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.
- C. Dewatering:
1. Contractor shall furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
 2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. No rubbish or waste material is permitted for fill or backfill.
 2. Provide all necessary sand for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris or earth with a high void content.
 5. Backfill all trenches and excavations immediately after installing pipes, or removal of forms, unless other protection is provided.
 6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.
 7. Lay all piping on a compacted bed of sand at least 3 inches deep. Backfill around pipes with sand, 6 inch layers, and compact each layer.
 8. Use sand for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand backfill to 6 inches above the top of the pipe.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

9. Place all backfill above the sand in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.
- F. Surface Restoration:
1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
 2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe wall penetrations are sealed.
 - b. Pipe identification is installed.
 - c. Branch piping in the location of sprinklers shall be dropped to the ceiling.
 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 - 4. Inspection report by the State Fire Marshal of the fire protection system.
 - 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div21.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Paper Copy Submittal Procedures:

1. Once the electronic version of the manuals has been approved by the Architect/Engineer, three (3) paper copies of the O&M manual shall be provided to the Owner. The content of the paper copies shall be identical to the corrected electronic copy.
2. Binder Requirements: The Contractor shall submit O&M manuals in heavy duty, locking three ring binders. Incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are **not** acceptable. Sheet lifters shall be supplied at the front of each notebook. The three-ring binders shall be 1/2" thicker than initial material to allow for future inserts. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other form of binding is acceptable.
3. Binder Labels: Label the front and spine of each binder with "Operation and Maintenance Instructions", title of project, and subject matter.
4. Index Tabs: Divide information by specification section, major equipment, or systems using index tabs. All tab titling shall be clearly printed under reinforced

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

plastic tabs. All equipment shall be labeled to match the identification in the construction documents.

- D. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copy of final approved test and balance reports.
 5. Copies of all factory inspections and/or equipment startup reports.
 6. Copies of warranties.
 7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 8. Dimensional drawings of equipment.
 9. Capacities and utility consumption of equipment.
 10. Detailed parts lists with lists of suppliers.
 11. Operating procedures for each system.
 12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 13. Repair procedures for major components.
 14. List of lubricants in all equipment and recommended frequency of lubrication.
 15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. The instructions shall include:
 - 1. Explanation of all system flow diagrams.
 - 2. Maintenance of equipment.
 - 3. Start-up procedures for all major equipment.
 - 4. Explanation of seasonal system changes.
 - 5. Description of emergency system operation.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Sprinkler System(s) - 4 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

- A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services

required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of fire protection drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the fire protection systems.
- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Color of paint shall be as follows:
 - a. As selected by architect

3.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

END OF SECTION

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. Fire protection system operational.
4. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 21 05 29
FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Cutting of Openings.
- E. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

- A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- D. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
- E. NFPA 13 - Standard for the Installation of Sprinkler Systems.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 21 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

- A. Hanger rods for single rod hangers supporting steel piping shall conform to the following:

<u>Pipe Size</u>	<u>Rod Size</u>
4" and smaller	3/8"
5", 6", 8"	1/2"

- B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.3 PIPE HANGERS AND SUPPORTS

- A. General:
 - 1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89, and 127 (where applicable).

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

Acceptable Products:

Anvil -	Fig. CT121
Cooper/B-Line -	Fig. B3373CT
Erico -	Model 510
Nibco/Tolco -	Fig. 82

2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.
3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.

2. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type:

Service:	Bare Metal Pipe
	Rigid Plastic Pipe

Acceptable Products:	Bare Steel Pipe

Anvil	Fig. 260
Cooper/B-Line	Fig. 3100
Erico	Model 400
Nibco/Tolco	Fig. 1

b. Adjustable Swivel Ring Type:

Service:	Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe

Anvil	Fig. 69
Cooper/B-Line	Fig. B3170NF
Erico	Model FCN
Nibco/Tolco	Fig. 200

3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per

manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
5. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
6. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
 - a. Clamp Type:
Service: Bare Metal Pipe
Rigid Plastic Pipe
 - 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
 - 2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel Pipe
Unistrut	Fig. P1100 or P2500
Cooper/B-Line	Fig. B2000 or B2400
Nibco/Tolco	Fig. A-14 or 2STR

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
 - a. Steel Structure Clamps:
 - 1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

Acceptable Products:	
Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

- 2) Scissor Type Beam Clamps (for use with bar-joists and wide flange):

Acceptable Products:	
Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

- b. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-14. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

- c. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- 2. Steel Structure Welding:
 - a. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

2.4 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

- 1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
- 2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

- 1. Refer to Section 21 05 50 for additional requirements for concrete bases in seismic applications.
- 2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).
- 3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
- 4. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
- 5. Equipment requiring bases is as follows:
 - a. Air Compressor
 - b. Tank

C. Supports:

- 1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
- 2. Hang heavy equipment from concrete floors or ceilings with Architect-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

- D. Grout:
 - 1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
 - 2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
 - 3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.6 PIPE SLEEVES AND LINTELS

- A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve or thermoplastic with integral water seal and textured surface.
 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
 4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
 5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
 6. Acceptable Manufacturers: Thunderline Corporation "Link-Seals", O-Z/Gedney Company, Calpico, Inc., Innerlynx, or Metraflex Company (cold service only).

2.7 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.8 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.9 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.10 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
 - 1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
 - 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- H. Spacing of hangers shall in no case exceed the following:

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
1.	Steel (All steel pipe unless otherwise noted):	
	1-1/4" & under	12'-0"
	1-1/2" & larger	15'-0"
2.	Steel (Schedule 40 lightweight alternative):	
	3" & under	12'-0"
I.	Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.	

END OF SECTION

SECTION 21 05 50
SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

- A. General:
1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
 2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
 3. These requirements are beyond those listed in Section 21 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.
- B. Manufacturer:
1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
 2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.
- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.
- D. Installer: Company specializing in performing the work of this Section.
- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:
1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
 2. Unistrut Corporation <http://www.unistrut.us/>
 3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
 4. Mason Industries, Inc. www.mason-ind.com.
 5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
 6. Tolco (909) 737-5599, www.tolco.com
 7. ISAT 877.523.6060, www.isatsb.com
 8. Vibro-Acoustics (416) 291-7371 , <https://virs.vibro-acoustics.com/>

1.3 REFERENCES

- A. International Building Code, 2015.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. ASCE 7-10, Chapter 13.
- D. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.
- E. NFPA 13 - Installation of Sprinkler Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Section 21 05 00.
- B. Shop Drawings:
 - 1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
 - 2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
 - 3. Manufacturer's Certifications: Professional Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
 - 4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
 - 5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along

with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the International Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. The following criteria are applicable to this project:
 - 1. Risk Category: II
 - 2. Seismic Factor: $I_E = 1.0$
 - 3. Seismic Design Category: C
 - 4. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 13.5-1 in ASCE 7-14 for the individual equipment or system being restrained.
 - 5. Component Importance Factors (I_p) shall be taken from Section 13.1.3 in ASCE 7-14 for the individual equipment or system being restrained.
 - 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- B. Forces shall be calculated with the above requirements and Equation 13.3-1, -2, and -3 of ASCE 7-14, unless exempted by 13.1.4

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- C. Equipment shall meet International Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.
 - 2. Remain Operational:
 - a. Requirements for "Stay in Place" listed above shall be met.
 - b. The following systems and associated equipment are intended not to fail externally or internally and are intended to remain operational.
 - 1) Fire Protection

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
 - 2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 - 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.

4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Housekeeping Pads:
1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
1. Air Compressors
 2. Tanks
 3. Fire Protection Equipment

2.4 MATERIALS

- A. Use the following materials for restraints:
1. Indoor Dry Locations: Steel, zinc plated.
 2. Outdoors and Damp Locations: Galvanized steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings and matched to the type and size of anchor bolts and studs used.

- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 1011, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

[***OR*****]**
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Do not brace a system to two different structures such as a wall and a ceiling.
- V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- W. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
- Y. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 21 05 53
FIRE SUPPRESSION IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 21.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kv Cables.
D. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

Plastic tags may be used for outside diameters under 3/4".

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
 - 1. All valves (except shutoff valves at equipment) shall have numbered tags.
 - 2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 - 3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 - 4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - 5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
 - 6. Number all tags and show the service of the pipe.
 - 7. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:
 - 1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 - 2. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
- E. Equipment:
 - 1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
 - 2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.

- 3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
FIRE PROTECTION WATER	White	Red

END OF SECTION

SECTION 21 13 00
FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, Fittings, Valves, and Connections for Fire Protection System.
- B. Wet-Pipe Sprinkler System.
- C. Dry-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME Code.
- B. Equipment and Components: Bear UL label or marking.
- C. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.
- D. Specialist Firm: Company specializing in sprinkler systems with minimum three years' experience.
- E. Sprinkler design drawings submitted by the Contractor shall be prepared by a NICET Water-Based Fire Protection Systems Layout Level III or Level IV designer or PE, and signed and sealed by a Professional Engineer licensed in the state where the project is located.
- F. All work shall be in accordance with NFPA 13.

1.3 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-Welding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- G. ANSI/ASME B16.25 - Butt-Welding Ends.
- H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
- J. ANSI/ASTM A47 - Malleable Iron Castings.
- K. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- L. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- M. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- N. ASME - Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Requirements.
- O. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- P. AWS A5.8 - Brazing Filler Metal.
- Q. AWS B2.2 - Standard for Brazing Procedure and Performance Qualification.
- R. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- S. IBC - International Building Code.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- T. MSS SP-73 - Brazing Joints for Wrought and Cast Copper Alloy Solder Joint and Pressure Fittings.
- U. NFPA 101 - Life Safety Code,
- V. NFPA 13 - Installation of Sprinkler Systems.
- W. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- X. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- Y. UL - Underwriter's Laboratory Fire Protection Equipment Directory.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.
- B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.
- C. Submit detailed working drawings and obtain review of them in the following order:
 - 1. Engineer/Architect.
 - 2. State Fire Marshal/Authority Having Jurisdiction
 - 3. Owner's Insurance Company
 - 4. Architect/Engineer

Begin construction after all approvals are received.

- D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.
- E. Submit dry-pipe calculations including water delivery time and air supply refill defined in NFPA 13. Water delivery time and air supply shall meet the requirements set forth in NFPA 13.
- F. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- G. Provide the Owner with one copy of NFPA 25. *Standard for the Inspection Testing and Maintenance of Water-based Fire Protection Systems.*

1.5 EXTRA STOCK

- A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store valves and sprinklers in shipping containers, with labels in place.
- B. Provide temporary protective coating on iron and steel valves.
- C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION

- A. System shall cover building areas noted.
- B. System shall interface with building fire alarm system. Provide all required wiring.
- C. Provide wet pipe sprinkler system(s) to NFPA 13 and building code requirements as required by Owner's insurance company and as shown on the drawings.

1.9 REGULATORY REQUIREMENTS

- A. All material, equipment, and installation shall be approved by the Authorities Having Jurisdiction and the Owner's Insurance Company.
- B. The Authorities Having Jurisdiction and the Owner's Insurance Company shall have precedence over the drawings and specifications in case of discrepancies.
- C. The entire installation shall comply with all applicable codes.

1.10 SYSTEM DESIGN

- A. Design and install a complete, hydraulically calculated wet-pipe and dry pipe sprinkler system for the portions of the building indicated on drawings. Systems shall be hydraulically calculated in accordance with the applicable design standard(s). Contractor is responsible for final pipe sizing based on results from hydraulic calculations. Pipe sizing shown on drawings for service entrance and main risers is preliminary and for coordination purposes only.
- B. Provide all required equipment and accessories.
- C. System shall include a 5 psi allowance for future decrease in available pressure and an allowance for inside and outside hose streams.
- D. Provide monitor switches on all shutoff valves.
- E. Install sprinkler riser in location shown on drawings or as approved by the Architect/Engineer.
- F.

1.11 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 21 05 00 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.12 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.13 JOB CONDITIONS

- A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - WET PIPE SPRINKLER SYSTEMS

- A. Piping – 2" and Under:
1. Design Pressure: 175 psig
 2. Pipe: Schedule 40, black steel, ANSI/ASTM A53, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 3. Joints: Threaded, grooved, or flanged.
 4. Fittings:
 - a. Threaded:
 - 1) Cast iron, Class 125, black, UL, ANSI/ASME B16.4, ASME A153.
 - 2) Malleable iron, Class 150, black, UL, ANSI/ASME B16.3, ASME A153.
 - 3) Ductile iron, Class 150, black, UL, ANSI/ASME B16.3, ASME A153.
 - b. Grooved:
 - 1) Ductile iron housing ASTM A-536, Grade 65-45-12, UL, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Carbon steel bolts and nuts.
 - c. Flanged:
 - 1) Cast iron, Class 125, black, UL, ANSI/ASME B16.1, ASME A153.
 5. Unions: Class 150 malleable iron, ANSI B16.39, ground joint with copper or copper alloy-to-iron seat.
- B. Piping – 2-1/2" and Above:
1. Design Pressure: 175 psig
 2. Pipe: Schedule 40, black steel, ANSI/ASTM A53, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 - a. Joints: Grooved or flanged.

b. Fittings:

1) Grooved:

- a) Ductile iron housing ASTM A-536, Grade 65-45-12, UL/FM, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Carbon steel bolts and nuts.

2) Flanged:

- a) Cast iron, Class 125, black UL, ANSI/ASME B16.1, ASME A153.

2.2 FLEXIBLE FIRE SPRINKLER CONNECTIONS

- A. Flexible Connection: Stainless steel hose, 175 psig max working pressure, fully welded non-mechanical fittings, stainless steel braid, maximum of 6' hose length, leak-tested with a minimum 7/8" internal corrugated hose diameter made of 304 stainless steel, end fittings made of carbon or stainless steel. Outlet of end fittings shall be 1/2" or 3/4" to match sprinkler connection. UL/FM.
- B. Ceiling Bracket: G90 galvanized steel, direct attachment type, integrated snap-on clip ends, tamper resistance screws, removable attachment hub with set screw for attachment and adjustment of stainless steel hose.
- C. Acceptable Manufacturers: Flexhead Industries, Victaulic VicFlex, Sprinkflex, or approved equal.

2.3 VALVE OPERATORS

- A. Provide handwheels for gate valves. Provide gear operators for butterfly valves.

2.4 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe.

2.5 EQUIPMENT

- A. Equipment shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING

- A. General Installation Requirements:
 - 1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
 - 2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
 - 3. Die cut screw joints with full cut standard taper pipe threads.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Coat threads with pipe joint compound or wrap with Teflon tape.
5. Locate piping to minimize obstruction of other work.
6. Route piping in concealed spaces above finished ceiling.
7. Use full and double lengths of pipe wherever possible.
8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.
9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
10. Comply with manufacturer's installation instructions.

B. Steel Piping:

1. In steel piping, main sized saddle branch connections or direct connection of branches to main is permitted if main is one pipe size larger than the branch for up to 6" mains and if main is two pipe sizes larger than branch for 8" and larger mains. Do not project branch pipes into main pipes.

C. Wall/Floor Penetration:

1. Provide sleeves when penetrating floors and walls.
2. Seal pipes passing through exterior walls with a wall seal per Section 21 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 1.5" above finished floor.
3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.

D. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

E. Hangers and Supports:

1. Provide hangers and supports as required by NFPA 13 and UL, with the following exceptions:
 - a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
 - b. Do not install fasteners to carry the load in tension, unless absolutely necessary.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

F. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.

3.2 INSTALLATION - VALVES

A. Install gate valves with stems upright or horizontal, not inverted.

B. Backflow Preventer:

1. Units shall be field tested and tagged in accordance with manufacturer's instructions by a certified tester before initial operation.
2. Install unit between 12" and 60" above finish floor.

C. Shutoff Valve:

1. Install buried shutoff valves in valve boxes. Provide post indicators.
2. Provide drain valves at main shutoff valves, low points of piping and apparatus.

3.3 INSTALLATION - EQUIPMENT

A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.

B. Test Valves:

1. Install test valves where required. Pipe to outdoors or drain. Test connection shall have flow equivalent to the smallest K-factor sprinkler.

C. Sprinklers:

1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.4 SYSTEMS CLEANING AND TESTING

A. General Requirement:

1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B. Underground Piping:

1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
 - a. 390 gpm for 4" pipes.
 - b. 880 gpm for 6" pipes.
2. Branches from existing or new underground mains to sprinkler risers shall be flushed out through two 2-1/2" hoses (with flow through open hose butts) attached to the riser with 4" temporary piping. Flushing through the drain of an alarm check or dry pipe valve is not acceptable.

C. Interior Piping:

1. Verify adequate water flow at the inspector's test connection.
2. Flush all interior piping to remove scale and other foreign material before placing system into service.
3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig more than the normal system working pressure for systems subjected to pressures more than 150 psig. Maintain test pressure for 2 hours without loss of pressure. Test shall be performed with dry pipe valves in open position to prevent valve damage.

D. Fire Alarm System:

1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.
2. Adjust all monitor switches for proper operation.

END OF SECTION

SECTION 21 30 00
FIRE PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire Pump Package.
- B. Fire Pump Motor.
- C. Electric Pressure Maintenance (Jockey) Pump.
- D. Controllers.

1.2 QUALITY ASSURANCE

- A. Provide pumps with manufacturer's name, model number, and rating/ capacity.
- B. Test pump, driver, and controller in accordance with NFPA 20. Test shall be witnessed by authority having jurisdiction.
- C. Manufacturer: Company specializing in manufacture of the products in this section with minimum three years experience.
- D. Installer: Company specializing in performing the work of this section with minimum three years experience.
- E. Equipment and components bear UL label or marking.
- F. Source Limitations: Obtain fire pumps, pressure maintenance pumps, and controllers through one source.
- G. Perform work in accordance with State of California Standards.

1.3 REFERENCES

- A. NEMA MG-1 - Motors and Generators.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum).
- C. NFPA 20 - Installation of Centrifugal Fire Pumps.
- D. NFPA 24 - Private Fire Service Mains and Their Appurtenances.
- E. UL - Fire Protection Equipment Directory.
- F. UL 448 - Pumps for Fire Protection Service.
- G. UL 1478 - Fire Pump Relief Valves.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 21 05 00 and Section 21 13 00.
- B. Product Data: For each type of product indicated, include pump type, rated capacities, power requirements (including in-rush current draw upon pump start-up), certified pump performance curves with each selection point indicated, NPSH curve, operating characteristics, and furnished accessories and specialties for each fire pump and pressure maintenance pump.
- C. Shop Drawings: For fire pumps and drivers, fire pump controllers, fire pump accessories and specialties, pressure maintenance pumps, pressure maintenance pump controllers,

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

and pressure maintenance pump accessories and specialties, include plans, elevations, sections, details, and attachments to other work.

- D. Submit Manufacturer's Installation Instructions: Include start-up instructions for fire pump.
- E. Submit Manufacturer's Certification that fire pumps meet or exceed specified requirements at specified operating conditions.
- F. Submit summary of hydrostatic test and field acceptance tests performed in accordance with NFPA 20.
- G. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept fire pumps and components at site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.
- B. Protect fire pumps and components from damage, including weather, water and construction debris.
- C. Provide temporary inlet and outlet caps, and maintain in place until installation.

1.6 SYSTEM DESCRIPTION

- A. Electric motor driven vertical in-line fire pump with jockey pump and electric controllers.

1.7 REGULATORY REQUIREMENTS

- A. All materials and installation shall conform to NFPA 20.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.
- C. All material, equipment and installation shall be approved by the State Fire Marshal and the Owner's insurance company.
- D. The State Fire Marshal shall have precedence over the drawings and specifications in case of discrepancies.

1.8 OPERATION AND MAINTENANCE DATA

- A. Include manufacturer's instructions, start-up data, and trouble-shooting check lists for pumps, drivers and controllers, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire pump, driver and controller for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fire Pumps:
 - 1. Aurora Pumps
 - 2. Fairbanks Morse
 - 3. Peerless Pump
 - 4. A-C Pump; ITT Industries
 - 5. Patterson Pump
- B. Controllers:
 - 1. Aquarius
 - 2. Firetrol
 - 3. Masters
 - 4. Cutler-Hammer

2.2 VERTICAL IN-LINE PUMPS

- A. Type: UL 448, vertical, single stage, close coupled, radially split casing, for in-line mounting, for 250 psi fire pump shall be capable of furnishing not less than 150 percent of rated capacity at not less than 65 percent of total rated head and with shutoff head limited to 140 percent of total rated head. Factory assembled and tested to comply with NFPA 20.
- B. Casing: Cast or ductile iron, with suction and discharge gauge ports, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- C. Impeller: Bronze, fully enclosed, statically and dynamically balanced, keyed directly to motor shaft.
- D. Shaft: Solid alloy steel with bronze sleeve.
- E. Seal: Packing gland with minimum four rings graphite impregnated packing and lantern rings, 230°F maximum continuous operating temperature.
- F. Wear Rings: Replaceable, bronze.
- G. Finish: Manufacturer's standard red paint.
- H. Provide nameplate complete with rated capacities and pump characteristics.
- I. Performance: Refer to Schedule on drawings.

2.3 FIRE PUMP ACCESSORIES

- A. OS&Y gate valve on pump suction.
- B. If necessary to reduce pipe size at pump suction flange, provide eccentric reducer.
- C. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.
- D. Fire pump bypass with OS&Y gate or butterfly valves and check valve.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Suction pressure gauge with snubber, valve and lever handle.
- F. Discharge pressure gauge mounted on board attached to pump, with snubber, valve and lever handle.
- G. Casing 3/4" relief valve.
- H. Float operated 3/4" 1" automatic air release valve.
- I. Fire pump test connection with 2-1/2" hose valves with caps and chains.
- J. Splash shield between pump and motor.
- K. Finish: Manufacturer's standard red paint.

2.4 ELECTRIC MOTOR DRIVE

- A. Motor: UL listed, squirrel cage induction type; in open drip-proof NEMA MG1 enclosure, 3550 RPM complying with NFPA 20 and NFPA 70.
- B. Controller: UL 218 and NFPA 20, full service type with solid state reduced voltage starter across the line starter VFD and electrical characteristics as scheduled on the drawings, in NEMA 3R enclosure, combined automatic and manual operation, factory assembled and wired, and factory tested for capacities and electrical characteristics, including the following:
 - 1. Disconnect Means: Externally operable, quick-break type.
 - 2. Circuit Breaker: Continuous current rating not less than 600% of the rated full load current of the motor. Overcurrent sensing elements of the non-thermal type. Instantaneous short circuit current rating for 100,000 amperes interrupting capacity and service entrance rated.
 - 3. Locked Rotor Protection: Calibrated and set at a minimum of 600% of full load current.
 - 4. Motor Starter: Energized automatically by pressure switch or manually by externally operable handle.
 - 5. Pressure Switch: Water pressure actuated switch with independent high and low calibrated adjustments responsive to water pressure in fire suppression piping. This Contractor is responsible for determining and setting start and stop pressures based on hydraulic calculations, available water pressure, required system pressure, controller manufacturer's recommendations, and NFPA requirements. If the fire pump is serving a sprinkler system, the activation of one sprinkler shall be sufficient to bring on the fire pump.
 - 6. Running Timer: Keeps motor operating when started automatically, for at least ten minutes.
 - 7. Pilot Lamp: Indicates circuit breaker closed and power available.
 - 8. Ammeter and voltmeter built into enclosure.
 - 9. Built-in Alarm: Energizes alarm to indicate circuit breaker open or power failure.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

10. Remote start switch relay.
11. Contacts for monitoring PHASE LOSS, PHASE REVERSAL, PUMP RUNNING, and ALTERNATE SOURCE.
12. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous metal sensing piping, NPS 1/2, with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with 3/32 inch orifice in clapper or ground face union with non-corrosive diaphragm having 3/32 inch orifice.
13. Automatic Transfer Switch connected to primary and alternate power source: UL 218 and UL 1008 and requirements for and attached to fire pump controllers. Include enclosure complying with UL 50, Type 2, with automatic transfer switch with rating at least equal to fire pump driver motor horsepower. Include ampere rating not less than 115 percent of motor full load current and suitable for switching motor locked rotor current. Instantaneous short circuit current rating for 100,000 amperes interrupting capacity and service entrance rated.
14. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
15. Surge Protection: Provide a factory-installed listed surge protection device with the fire pump controller.
16. System Pressure Recorder: Digital type with memory.
17. Finish: Manufacturer's standard red paint.

2.5 PRESSURE MAINTENANCE (JOCKEY) PUMP

- A. Pressure Maintenance Pumps: Factory assembled and tested pumps with electric motor driver, controller, and accessories and specialties. Include cast iron or stainless steel casing and bronze or stainless steel impellers, mechanical seals, and suction and discharge flanges machined to ASME B16.1, Class 125 dimensions unless Class 250 flanges are indicated and except that connections may be threaded in sizes where flanges are not available.
- B. Electrically operated, vertical turbine type with NEMA MG1, open drip-proof squirrel cage induction motor complying with NFPA 20 and NFPA 70. Include wiring compatible with controller used.
- C. Provide suction and discharge pressure gauges.
- D. Provide with pressure relief valve and pipe to outdoors.
- E. Control by automatic jockey pump controller to start pump on pressure drop in system. Fire pump starts automatically on further pressure drop or on jockey pump failure.
- F. Controllers: UL 508, factory assembled, wired, and tested across the line type for combined automatic and manual operation.
 1. Enclosure: UL 508 and NEMA 250, Type 2, wall mounting type for field electrical wiring.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous metal sensing piping, NPS 1/2, with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with 3/32 inch orifice in clapper or ground face union with non-corrosive diaphragm having 3/32 inch orifice.
 3. Rate controller for scheduled horsepower, and include the following:
 - a. Fusible disconnect switch.
 - b. Pressure switch.
 - c. Hand-off-auto selector switch.
 - d. Pilot light.
 - e. Running period timer.
 4. Finish: Manufacturer's standard color paint applied to factory assembled and tested unit before shipping.
- G. Performance: Refer to schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions, NFPA 20, and NFPA 37.
- B. Provide at least the manufacturer's recommended minimum service space around pumps.
- C. Coordinate work of this section with other affected work.
- D. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. For base mounted pumps, provide supports under suction and discharge elbows. Refer to Section 21 13 00.
- E. Provide drains for bases and seals, piped to and discharging into floor drains.
- F. Install eccentric reducer at suction flange with flat side on top to avoid air pockets in suction piping.
- G. Lubricate pumps before start-up.
- H. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.
- I. Mount unit on vibration isolators. Refer to Section 21 05 48.
- J. Control and Signal Cabling: Provide control and signal cabling per manufacturer recommendations for the following system components.
 1. Remote annunciator

END OF SECTION

SECTION 22 05 00
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Extend and modify existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - c. Furnish and install water heaters.
 - d. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
 - e. Extend and modify existing sanitary sewer and vent system.
 - f. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 22 05 50.
 - 2. Heating Work shall include, but is not necessarily limited to:
 - a. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
 - b. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
 - c. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install modular indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install all terminal air boxes and reheat coils.
 - f. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - g. Extend and modify existing temperature control systems.
 - h. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
4. Temperature Control Work shall include, but is not necessarily limited to:
 - a. Extend and modify existing temperature control system as specified in Section 23 09 00 to serve new equipment.
 - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
 - c. Furnish automatic control valves and dampers for installation by others.
 - d. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
 - e. This Contractor shall install all devices so noted in Section 23 09 00.
5. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Extend and modify existing wet pipe sprinkler system for areas noted on the drawings.
 - b. Furnish and install all items listed on the Fire Protection Material List.
 - c. Furnish all hydraulic calculations and working sprinkler drawings.
 - d. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 21 05 50.
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Fire Protection Contractor.
 - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Condensing Units.
 - b. Air Handling Units.
 - c. Modular Air Handling Units.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Temperature Control Subcontractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
 - 4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
 - 1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
 - 2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
 - 3. Provides motor control and temperature control wiring, where so noted on the drawings.
 - 4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
 - 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

- A. Definitions:
 - 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
 - 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
 - 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 - 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 - 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
 - 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
 - 2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Linn, Missouri Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of Linn-State Technical College.
3. Conform to all State Codes.
4. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
5. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
6. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

7. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 8. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 9. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for service connections.
 4. Make application for and pay for all meters and metering systems required by the utility company.
- F. Examination of Drawings:
1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
22 05 00	Owner Training Agenda
22 05 48	Vibration Isolation Equipment
22 05 50	Seismic Restraint Systems
22 09 00	Instrumentation
22 10 00	Plumbing Piping Systems and Valves
22 10 30	Plumbing Specialties
22 11 23	Domestic Water Pumps
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where

possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

- a. Submittal file name: 22 XX XX.description.YYYYMMDD
- b. Transmittal file name: 22 XX XX.description.YYYYMMDD

- 5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.7 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.
- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Seismic Restraints and Equipment Bracing
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.13 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.14 CONTINGENCY

- A. The Plumbing Contractor shall include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris or earth with a high void content.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

5. Backfill all trenches and excavations immediately after installing pipes, or removal of forms, unless other protection is provided.
6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.
7. Lay all piping on a compacted bed of sand at least 3 inches deep. Backfill around pipes with sand, 6 inch layers, and compact each layer.
8. Use sand for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand backfill to 6 inches above the top of the pipe.
9. Place all backfill above the sand in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected,

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Paper Copy Submittal Procedures:

1. Once the electronic version of the manuals has been approved by the Architect/Engineer, three (3) paper copies of the O&M manual shall be provided to the Owner. The content of the paper copies shall be identical to the corrected electronic copy.
2. Binder Requirements: The Contractor shall submit O&M manuals in heavy duty, locking three ring binders. Incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are **not** acceptable. Sheet lifters shall be supplied at the front of each notebook. The three-ring binders shall be 1/2" thicker than initial material to allow for future inserts. If more than one

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other form of binding is acceptable.

3. Binder Labels: Label the front and spine of each binder with "Operation and Maintenance Instructions", title of project, and subject matter.
4. Index Tabs: Divide information by specification section, major equipment, or systems using index tabs. All tab titling shall be clearly printed under reinforced plastic tabs. All equipment shall be labeled to match the identification in the construction documents.

D. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 - 1. Explanation of all system flow diagrams.
 - 2. Maintenance of equipment.
 - 3. Start-up procedures for all major equipment.
 - 4. Explanation of seasonal system changes.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Domestic Hot Water System - 2 hours.
 - 2. Water Softener System - 2 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of plumbing drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the plumbing systems.
- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Color of paint shall be as follows:
 - a. As selected by architect.

3.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

END OF SECTION

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 22 05 13
MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. Energy Independence and Security Act of 2007.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

PART 2 - PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Explosion-Proof Motors: UL listed and labeled for the hazard classification shown on the drawing, with over-temperature protection.
- D. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- E. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- F. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- G. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- H. Each contractor shall set all motors furnished by him.
- I. All motors shall have a minimum service factor of 1.15.
- J. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- K. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- L. Aluminum end housings are not permitted on motors 15 HP or larger.
- M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.
- N. Motors for pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control.

2.2 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

- A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

HP	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5

B. Motor nameplate shall be noted with the above ratings.

2.3 MOTOR DRIVEN EQUIPMENT

- A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
- B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

2.4 SHEAVES

- A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.
- B. When replacing sheaves, use sheaves of at least the originally supplied sizes.
- C. Contractor responsible for motor shall also be responsible for replacement sheaves. Coordinate with testing and balancing of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

END OF SECTION

SECTION 22 05 16
PLUMBING EXPANSION COMPENSATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Expansion Joints and Compensators.
- B. Pipe Loops, Offsets, and Swing Joints.

1.2 REFERENCES

- A. Conform to Standards of Expansion Joint Manufacturer's Association.

1.3 DESIGN CRITERIA

- A. Unless noted otherwise, base expansion calculations on 50°F installation temperature to 140°F for domestic hot water, plus 30% safety factor.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

- A. Type EJ-4:
 - 1. Assembly consisting of two flexible connectors, two stainless steel flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
 - 2. Connectors shall have corrugated stainless hose bodies with stainless steel braided casings.
 - 3. Connectors shall be rated for 150 psi working pressure at 70°F and 100 psi at 800°F.
 - 4. Sizes 2" and smaller shall have steel threaded connections.
 - 5. Sizes 2-1/2" and larger shall have 150 lb steel flanges.
 - 6. Connectors shall be suitable for 1/2" permanent misalignment.
 - 7. Acceptable Manufacturer: Metraflex Type ML.
- B. Alignment Guides:
 - 1. Bolted semi-steel spider.
 - 2. Bolted guiding cylinder with supporting legs welded to pipe support.
 - 3. Sized to allow insulation to pass through the outer cylinder.
 - 4. Acceptable Manufacturers: American BOA, Hyspan, Flexonics, Keflex, or Metraflex.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Accomplish structural work and provide equipment required to control expansion and contraction of piping; including loops, offsets, swing joints, and expansion joints where required.
- B. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so all movement occurs along axis of pipe only.
- C. Each expansion joint shall have either one anchor or two alignment guides on each side of it. Guides shall be located within 4 and 14 pipe diameters of the expansion joint or as recommended by the joint manufacturer.
- D. Preset all expansion joints to allow for expected expansion from installation temperature to operating temperature.

END OF SECTION

SECTION 22 05 29
PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- D. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 22 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2" and smaller	3/8"	3/8"
2-1/2" through 3-5/8"	1/2"	1/2"
4" and 5"	5/8"	1/2"
6"	3/4"	5/8"

Column #1: Steel pipe.
Column #2: Copper pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

a. Insulation Couplings:

- 1) Insulation Coupling: Molded thermoplastic, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
 - 2) Horizontal Strut Mounted Insulated Pipe:
 - a) Acceptable Manufacturers: Klo-Shure or equal.
 - 3) Vertical:
 - a) Acceptable Manufacturers: Klo-Shure Titan or equal.
3. Copper piping located in an exposed area, including indirect waste piping in janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

Acceptable Products:

Erico/M-Co	Model #456
B-Line	Fig. 3198HCT
Anvil	Fig. CT138R
Nibco/Tolco	Fig. 301CT

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

Acceptable Products:

Cooper/B-Line -	Fig B3373 Series
Erico -	510 Series
Nibco/Tolco -	Fig. 82

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
4. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

Acceptable Products:

Anvil - Fig. 160, 161, 162, 163, 164, 165
Cooper/B-Line - Fig. 3160, 3161, 3162, 3163, 3164, 3165
Erico - Model 630, 631, 632, 633, 634, 635
Nibco/Tolco - Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used.

Acceptable Products:

Cooper/B-Line - Fig. B3380 through B3384
Pipe Shields - A1000, A2000
Erico - Model 124, 127

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

6. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type:

Service: Bare Metal Pipe
 Insulated Hot Pipe - 3 inches & Smaller

Acceptable Products:	Bare Steel or Insulated Pipe	Bare Copper Pipe
Anvil	Fig. 260	
Cooper/B-Line	Fig. 3100	Fig. B3100C
Erico	Model 400	
Nibco/Tolco	Fig. 1	Fig. 81PVC

b. Roller Type:

Service: Insulated Hot Pipe - 4 inches and Larger

Acceptable Products:	4" through 6"	8" and Above
Anvil	Fig. 181, 271	Fig. 171, 271
Cooper/B-Line	Fig. 3110, 3117	Fig. 3114, 3117
Erico	Model 610	Model 605
Nibco/Tolco	Fig. 324, 327	Fig. 322, 327

c. Continuous Channel with Clevis Type:

Service: Plastic Tubing
 Flexible Hose
 Soft Copper Tubing

Acceptable Products:

Cooper/B-Line - Fig. B3106, with Fig. B3106V
 Erico - Model 104, with Model 104V
 Nibco/Tolco - Fig. 1V

d. Adjustable Swivel Ring Type:

Service: Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 69	
Cooper/B-Line	Fig. B3170NF	Fig. B3170CTC
Erico	Model FCN	102A0 Series
Nibco/Tolco	Fig. 200	Fig. 203

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

- Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type:

Service: Bare Metal Pipe
 Insulated Hot Pipe - 3 inches and smaller

- 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
- 2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel or Insulated Pipe	Bare Copper Pipe
Unistrut	Fig. P1100 or P2500	
Cooper/B-Line	Fig. B2000 or B2400	Fig. BVT
Nibco/Tolco	Fig. A-14 or 2STR	

b. Roller Type:

Service: Insulated Hot Pipe - 4 inches and larger.

Acceptable Products:	4" through 6"	8" and Above
Unistrut	Fig. P2474	Fig. P2474-1
Cooper/B-Line	Fig. B218	Fig. B219
Nibco/Tolco	Fig. ROL-12	Fig. ROL-13

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

2. Steel Structure Clamps

a. C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):

Acceptable Products:

Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

b. Scissor Type Beam Clamps (For use with bar-joists and wide flange):

Acceptable Products:

Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

3. Concrete

a. Concrete Inserts, Single Rod Galvanized:

Acceptable Products:

Anvil	Fig. 282
Cooper/B-Line	Fig. B3014
Erico	Model 355
Nibco/Tolco	Fig. 310

b. Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

Unistrut Corp	P3200 Series
Cooper/B-Line	Fig. B22-J
Erico	CONCT

c. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-14. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

d. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

4. Steel Structure Welding:

a. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.4 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 22 05 50 for additional requirements for concrete bases in seismic applications.
2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
 4. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
 5. Equipment requiring bases is as follows:
 - a. Expansion Tank
 - b. Water Heater
 - c. Water Softener
- C. Supports:
1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
 2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.
- D. Grout:
1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
 2. Use Mix No. 1 for clearances of 1" or less and Mix No. 2 for all larger clearances.
 3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.6 ROOF PENETRATIONS

- A. Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots. Material shall match roofing membrane.
- B. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

2.7 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
 - 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
 - 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
 - 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.

5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature	Silicone	-67°F to 400°F

6. Acceptable Manufacturers: Thunderline Corporation "Link-Seals", O-Z/Gedney Company, Calpico, Inc., Innerlynx, or Metraflex Company (cold service only).

2.8 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.9 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.10 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.11 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

- A. General Installation Requirements:
1. Install all items per manufacturer's instructions.
 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.
2. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
3. Set all concrete inserts in place before pouring concrete.
4. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
5. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
6. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the spacing as defined in 2016 CPC, Table 313.3 as applied to each piping system.
- I. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
1.	Steel (Std. Weight or Heavier – Liquid Service):	
	1-1/4" & under	7'-0"
	1-1/2"	9'-0"
	2"	10'-0"
	2-1/2"	11'-0"
	3"	12'-0"
	4" & larger	12'-0"
2.	Hard Drawn Copper (Liquid Service):	
	3/4" and under	5'-0"
	1"	6'-0"
	1-1/4"	7'-0"
	1-1/2"	8'-0"
	2"	8'-0"
	2-1/2"	9'-0"

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
	3"	10'-0"
	4"	12'-0"
	6"	12'-0"
3.	Hard Drawn Copper (Vapor Service):	
	3/4" & under	7'-0"
	1"	8'-0"
	1-1/4"	9'-0"
	1-1/2"	10'-0"
	2"	11'-0"
	2-1/2" & larger	12'-0"
4.	Flexible Plastic Pipe and Soft Copper Tubing:	
	a. Continuous channel with hangers maximum 8'-0" OC.	
5.	Rigid Plastic Pipe:	
	a. Hangers shall be spaced based on the piping system manufacturers' instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.	
6.	Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.	

END OF SECTION

SECTION 22 05 48
PLUMBING VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bases.
- B. Vibration Isolation.
- C. Flexible Connectors.

1.2 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00 and the Vibration Isolation Submittal Form at the end of this section.
- B. Vibration isolation submittals may be included with equipment being isolated but must comply with this section.
- C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- D. Isolator submittals shall include:
 - 1. Equipment served
 - 2. Type of Isolator
 - 3. Load in Pounds per Isolator
 - 4. Recommended Maximum Load for Isolator
 - 5. Spring Constants of Isolators (for Spring Isolators)
 - 6. Load vs. Deflection Curves (for Neoprene Isolators)
 - 7. Specified Deflection
 - 8. Deflection to Solid (at least 150% of calculated deflection)
 - 9. Loaded (Operating) Deflection
 - 10. Free Height
 - 11. Loaded Height
 - 12. Kx/Ky (horizontal to vertical stiffness ratio – for spring isolators)
 - 13. Materials and Coatings
 - 14. Spring Diameters
- E. Make separate calculations for each isolator on equipment where the load is not equally distributed.
- F. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.
- G. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 22 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 BASIC CONSTRUCTION AND REQUIREMENTS

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 22 05 50.
- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio (K_x/K_y) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. Provide motor slide rails for belt-driven equipment per Section 22 05 13.
- I. All isolators, except M1, shall have provision for leveling.

2.2 MOUNTINGS

- A. Type M1:
 1. 0.75" thick waffled neoprene pad with minimum static deflection of 0.07" at calculated load and 0.11" at maximum load. For loads less than 15 pounds, the deflection at calculated load requirement is waived, but the isolator must have a maximum stiffness of the ratio of 45#/0.35".

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

2. Units need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators.
3. Acceptable Manufacturers: Mason "Super W", Kinetics "NGS", Amber/Booth "SPNR", Vibration Eliminator Co. "400N".

2.3 HANGERS

A. Type H1:

1. Vibration hangers shall consist of a double-deflection neoprene element with a projecting bushing or oversized opening to prevent steel-to-steel contact.
2. Static deflection shall be at least 0.15" at calculated load and 0.35" at maximum rated load.
3. Provide hangers with end connections as required for hanging ductwork or piping.
4. Acceptable Manufacturers: Mason "HD" or "WHD", Kinetics "RH", Aeroflex "RHD", Vibration Eliminator Co. "ALH".

B. Type H2:

1. Vibration hangers shall contain a steel spring in a neoprene cup with a grommet to prevent short circuiting the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Acceptable Manufacturers: Mason "30" or "W30", Kinetics "SRH", Amber/Booth "BSRA", Aeroflex "RSH", Vibration Eliminator Co. "SNC".

C. Type H3:

1. Vibration hangers shall have a steel spring in a neoprene cup with a grommet to prevent short circuiting of the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

5. Hangers shall be capable of holding the load at a fixed elevation during installation. They shall have a secondary adjustment to transfer the load to the spring and maintain the same position.
6. Deflection shall be indicated by a pointer and scale.
7. Acceptable Manufacturer: Mason "PC30", Kinetics "SFH", Amber/Booth "BSW", Vibration Eliminator Co. "PCS".

2.4 FLEXIBLE CONNECTORS (NOISE AND VIBRATION ELIMINATORS)

A. Type FC1:

1. Spherical flexible connectors with multiple plies of nylon tire cord fabric and either EPDM or molded and cured neoprene. Outdoor units shall be EPDM.
2. Steel aircraft cables or threaded steel rods shall be used to prevent excess elongation.
3. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer.
4. Connectors up to 2" size may have threaded ends.
5. Connectors 2-1/2" and over shall have floating steel flanges recessed to lock raised face neoprene flanges.
6. All connectors shall be rated for a minimum working pressure of 150 psi at 200°F.
7. Acceptable Manufacturer: Metraflex "Double Cable-Sphere", Minnesota Flex Corp., Mercer "200 Series", Twin City Hose "MS2".

B. Type FC2:

1. Stainless steel flexible connectors with corrugated stainless steel hose body and stainless steel braided casing.
2. Rated for minimum working pressures of 150 psi at 70°F and 100 psi at 800°F.
3. Sizes 2" and under shall have steel threaded connections.
4. Sizes 2-1/2" and over shall have 150 lb. steel flanges.
5. Suitable for 1/2" permanent misalignment.
6. Acceptable Manufacturers: Mason or Mercer "BSS-GU", Metraflex "ML", Twin City Hose "TCHS", American "BOA B4-1", Flexible Metal Hose Company "FM-21", or Wheatley.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install all products per manufacturer's recommendations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as pipes supported on a strut rack.

3.2 PIPE ISOLATION

- A. The first three hangers from vibration-isolated equipment shall be type H1.
- B. For base mounted pumps without resilient mountings, the first five hangers shall be Type H1.
- C. Where piping is floor-supported, use M2 instead of H1 and M3 instead of H2.
- D. Install flexible connectors in all piping connected to vibration producing equipment. This includes all base-mounted pumps, compressors, etc. Absence of flexible connectors on piping diagrams does not imply that they are not required.
- E. Use Type FC1 where pressures are lower than 150 psi, temperatures are below 220°F, and the fluid handled is compatible with neoprene and EPDM.
- F. Use Type FC2 for all other services. FC2 shall be installed parallel with equipment shafts.
- G. Provide sufficient piping flexibility for vibrating equipment or furnish flexible connectors with appropriate temperature and pressure ratings.
- H. Vibration isolators shall not cause any change in position of piping that will result in stresses in connections or misalignment of shafts or bearings. Equipment and piping shall be maintained in a rigid position during installation. Do not transfer load to the isolators until the installation is complete and under full operational load. Hanger H3 and Mounting M4 may be used instead of other products for this purpose.
- I. Support piping to prevent extension of flexible connectors.

3.3 VIBRATION ISOLATION SCHEDULE

EQUIPMENT DESIGNATION	BASE TYPE	ISOLATOR TYPE	STATIC DEFLECTION	FLEXIBLE CONNECTIONS
Inline Pump(s)	NA	H2 or H3	0.75"	NA

END OF SECTION

VIBRATION ISOLATION SUBMITTAL FORM											
COLUMN 1	2	3	4	5	6	7	8	9	10	11	12
ITEM SERVED	MIN DEFL (")	PROPOSED ISOLATOR							CALCULATIONS		
		TAG	MODEL	MAX LOAD (#)	DEFL @ MAX LOAD (")	DEFL TO SOLID (")	FREE HT (")	Kx/Ky	LOAD (#)	DEFL (")	DEFL RATIO

- COLUMN NOTES: Note numbers correspond to the column numbers above.
- Item served should match designation on the design drawings.
 - List the deflection scheduled or specified in the design documents.
 - List the designation for this isolator. This is most useful when one item has multiple different isolators to support its weight.
 - List the manufacturer's complete model designation for the isolator.
 - List the manufacturer's maximum rated load for the isolator.
 - List the isolator deflection at the maximum rated load in column 5.
 - For spring isolators list the deflection when the springs are solid. This is not normally the same entry as in column 6.
 - List the height of the isolator when unloaded. Shop drawings must show where this is measured.
 - List the rated horizontal to vertical stiffness ratio. This must be between 0.8 and 2.0.
 - List the calculated equipment load on each isolator. For items with unequal weight distribution, calculate each isolator separately.
 - List the calculated deflection under the calculated load. For springs this will be column 10*(column 6 / column 5).
 - List the answer from dividing column 7 by column 11. This must be at least 1.5. If not, select an isolator with more nominal deflection.
- GENERAL NOTES:
- When submitting hangers or supports for a weight range, fill in two rows - one for the maximum and one for the minimum weight.

SECTION 22 05 50
SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 22 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation <http://www.unistrut.us/>
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371 , <https://virs.vibro-acoustics.com/>

1.3 REFERENCES

- A. International Building Code, 2015.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. ASCE 7-10, Chapter 13.
- D. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.
- E. NFPA 13 - Installation of Sprinkler Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Section 22 05 00.
- B. Shop Drawings:
 - 1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
 - 2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
 - 3. Manufacturer's Certifications: Professional Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
 - 4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
 - 5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along

with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the International Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, 2015 edition.
- B. The following criteria are applicable to this project:
 - 1. Risk Category: II
 - 2. Seismic Factor: $I_E = 1.0$
 - 3. Seismic Design Category: C
 - 4. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 13.5-1 in ASCE 7-14 for the individual equipment or system being restrained.
 - 5. Component Importance Factors (I_p) shall be taken from Section 13.1.3 in ASCE 7-14 for the individual equipment or system being restrained.
 - 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements and Equation 13.3-1, -2, and -3 of ASCE 7-14, unless exempted by 13.1.4.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Equipment shall meet International Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
 - 2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 - 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 - 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.

C. Housekeeping Pads:

1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
1. Pumps
 2. Tanks

2.4 MATERIALS

- A. Use the following materials for restraints:
1. Indoor Dry Locations: Steel, zinc plated.
 2. Outdoors and Damp Locations: Galvanized steel.
 3. Corrosive Locations: Stainless steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 1011, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

[***OR*****]**
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Water tanks shall be secured to their saddles by welding or proper concrete attachment, and those saddles shall be properly attached to the structure.
- V. Brace all terminal units with water coils as required by the building code and provide flexible connection to the coil if bracing is required.
- W. Independently brace duct mounted equipment (terminal units, in-line fans, etc.) and the associated suspended ductwork.
- X. Do not brace a system to two different structures such as a wall and a ceiling.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- Y. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- Z. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- AA. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
- BB. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 22.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

Plastic tags may be used for outside diameters under 3/4".

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- H. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- I. Tracer Wire:
 - 1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
 - 2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
 - 3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
 - 1. All valves (except shutoff valves at equipment) shall have numbered tags.
 - 2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 - 3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 - 4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - 5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
 - 6. Number all tags and show the service of the pipe.
 - 7. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:
 - 1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 - 2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
 4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.
- E. Equipment:
1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
 2. Provide engraved plastic tags at all hydronic or steam system makeup water meters.
 3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.
- F. Tracer Wire:
1. Tracer wire shall be installed on top of all non-metallic buried utilities.
 2. Tracer wire shall be taped directly to plastic water or drain pipe.
 3. Tracer wire shall not be fastened directly or indirectly to gas piping.
 4. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.
 5. Tape shall be Polyken "930-35", Protecto-Wrap "310", or approved equal.
 6. Tracer wire shall be continuous between boxes and shall be tested for continuity.
 7. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. **Wire nuts shall not be used.**
 8. The tracer wire shall daylight to grade through a 2" PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
DOMESTIC COLD WATER	White	Green
DOMESTIC HOT WATER - 140°F	Black	Yellow

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

Pipe Service	Lettering Color	Background Color
DOMESTIC HOT WATER CIRCULATING - 140°F	Black	Yellow
SANITARY SEWER	Black	Yellow
VENT	Black	Yellow
All Underground Pipes	Varies	Varies
Tracer Wire - Water Pipe Lines	---	Blue
Tracer Wire - All other buried types	---	Green

END OF SECTION

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment Insulation.
- B. Equipment Insulation Finishes.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM B209 – Aluminum and Aluminum Alloy Sheet and Plate
- C. ANSI/ASTM C534 – Elastomeric Foam Insulation
- D. ANSI/ASTM C921 – Properties of Jacketing Materials for Thermal Insulation
- E. ANSI/ASTM D1668 – Glass Fabric for Waterproofing
- F. ASTM E84 - Surface Burning Characteristics of Building Materials.
- G. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- H. NFPA 255 - Surface Burning Characteristics of Building Materials.
- I. UL 723 - Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Type A: Glass Fiber Blanket; ANSI/ASTM C612; 0.40 maximum 'K' value at 300°F; 3.0 lb./cu ft.; suitable to 850°F, 25/50 flame spread/smoke developed.
- B. Type B: Glass Fiber Board; ANSI/ASTM C612; 0.28 maximum 'K' value at 200°F; 6.0 lb./cu ft.; suitable to 850°F, 25/50 flame spread/smoke developed.
- C. Type C: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

2.2 INSULATION FINISHES

- A. Type 2: All Service Jacket; ASTM C921; Factory or Field Applied; Kraft paper bonded to aluminum foil reinforced with glass fiber; Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Seal all joints with manufacturer approved tape and adhesive to maintain vapor barrier. Indoor use only, if used outdoors add type 4 finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all materials per manufacturer's instructions, codes and industry standards.
- B. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.
- C. Do not insulate factory insulated equipment.
- D. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation. Secure to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier mastic.
- F. Do not insulate over nameplates or ASME stamps. Bevel and seal insulation around such, unless omitting insulation would cause condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items.
- G. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning; install specially fabricated removable insulation sections. Covers shall have mechanical fasteners and be reusable.
- H. Install 26 gauge galvanized sheet metal corner protection angles where insulation extends to the floor. Minimum 2" coverage of insulation.
- I. Insulate all equipment surfaces that are not factory insulated and are intended to operate below 60°F and/or above 100°F. Verify insulation type and thickness with equipment manufacturer and Architect/Engineer.
- J. Insulate all supports on equipment operating below ambient temperature.

3.2 INSULATION

- A. Type A and B:
 - 1. Apply with edges tightly butted and joints staggered.
 - 2. Secure with welded pins and washers, 4" from each edge and 16" on center, or 1/2" x 0.015" galvanized steel bands, 12" on center.
- B. Type C:
 - 1. Apply with edges tightly butted and joints staggered. Install multiple layers if required thickness is greater than 1" thick.
 - 2. Secure with manufacturer approved adhesive. Seal all joints with manufacturer approved adhesive.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3.3 SCHEDULE

Equipment					Insulation Type	Insulation Thickness	Insulation Finish
A.	Domestic Hot Water Storage Tank (up to 250°F)				B	2"	2

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- E. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- F. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
- G. ASTM E84 - Surface Burning Characteristics of Building Materials.
- H. NFPA 255 - Surface Burning Characteristics of Building Materials.
- I. UL 723 - Surface Burning Characteristics of Building Materials.
- J. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).
- B. Type B: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.
- C. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.35 maximum 'K' value at 75°F; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose white Kraft jacket for above grade installations.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 'K' value at 300°F; 1200°F maximum service temperature; 16 gauge stainless steel tie wires on maximum 12" centers.

2.2 VAPOR BARRIER JACKETS

- A. Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.
- B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

2.3 JACKET COVERINGS

- A. Plastic Jackets and Fitting Covers: High impact, glossy white, 0.020" thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40°F to 150°F. 25/50 maximum flame spread/smoke developed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

- A. General Installation Requirements:
 - 1. Install materials per manufacturer's instructions, building codes and industry standards.
 - 2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
 - 3. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70°F), with a minimum compressive strength of 50 psi. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
 - 4. Neatly finish insulation at supports, protrusions, and interruptions.
 - 5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation

as required to maintain the vapor barrier, or add separate vapor barrier jacket.

6. Shields shall be at least the following lengths and gauges:

	Pipe Size	Shield Size
a.	1/2" to 3-1/2"	12" long x 18 gauge
b.	4"	12" long x 16 gauge
c.	5" to 6"	18" long x 16 gauge

7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.

8. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.
3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.
2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.

E. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping does not need to be insulated if less than four feet in developed length. If piping is longer than four feet in developed length, the piping shall be insulated and have a plastic jacket.

3.3 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
2. Self-seal insulation may be used on pipes operating below 170°F.

C. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

D. Type D Insulation:

1. Use pre-molded half sections. Butt longitudinal and circumferential joints tightly. Wire in place with 16 gauge stainless steel wire on maximum 12" centers.
2. Apply in two layers. Stagger all joints between layers. Wire each layer individually.

3.4 JACKET COVER INSTALLATION

A. Plastic Covering:

1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.
2. Solvent weld all joints with manufacturer recommended cement.
3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Use plastic insulation covering on all exposed pipes including, but not limited to:
- a. All exposed piping in areas noted on drawings.
 - b. All exposed piping below 8'-0" above floor.
 - c. All piping in mechanical rooms and/or tunnels that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)

3.5 SCHEDULE

Piping System		Insulation Type/Thickness	
A.	Domestic Hot Water & Circulating - Potable and Non-Potable - up to 140°F		
	Up to 1-1/2" Pipe Size	A / 1"	
	Above 1-1/2" Pipe Size	A / 1-1/2"	
B.	Domestic Cold Water - Potable and Non-Potable	A / 1"	
C.	Plumbing Vents Within 10' from Roof Penetration	A / 1/2"	OR B / 1/2"
D.	Cooling Coil Condensate Drains & Dedicated Floor Drain Branch Piping, Sanitary and Indirect Waste Piping Conveying Fluids below 55°F	B / 1/2"	
E.	Above Grade Drains at Ice Machines (include drain bodies, P-trap, and 10' of downstream drain piping)	A / 1"	OR B / 1"
F.	Insulation Inserts at hangers	C or D - Match pipe insulation thickness	

END OF SECTION

SECTION 22 09 00
INSTRUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pressure Gauge.
- B. Pressure Gauge Accessories.
- C. Thermometers.
- D. Test Plugs.

1.2 REFERENCES

- A. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
- B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.
- C. ASTM E1 - Specification for ASTM Thermometers.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00. Include list that indicates use, operating range, total range and location for manufactured components.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Gauges shall be 4-1/2" diameter with aluminum or stainless steel case with phosphor bronze bourdon tube, brass socket for water or oil application, 1/4" or 1/2" bottom connection. Gauges shall be 1% full scale accurate with bronze bushed brass movement and adjustable pointer. Standard ranges to be either pressure or pressure and vacuum as required of application.
- B. Acceptable Manufacturers: Ashcroft, Marsh, Marshalltown, Miljoco, Terice, U.S. Gauge Figure 1901, Weiss, Weksler, Wika.
- C. Select gauge range for normal reading near center of gauge.

2.2 PRESSURE GAUGE ACCESSORIES

- A. All pressure gauges shall have valves and pressure snubbers. All pressure gauges on steam shall have pigtail syphon.
- B. Shutoff Valve: 1/4" ball valve as specified for each piping system.
- C. Pressure snubber, brass with 1/4" connections, porous metal type.

2.3 THERMOMETERS

- A. Alcohol/Spirit Filled Type:
 - 1. 9" long phenolic case, steel stem, accuracy of 1% full scale. Adjustable elbow joint with 180 degree adjustment in vertical plane, 360 degree adjustment in

horizontal plane, and locking device to allow rotation of thermometer to any angle.

2. Select thermometer for appropriate temperature range.
3. Stem: Copper plated steel, aluminum, or brass for separable socket. Stem lengths as required for application with minimum insertion of 3-1/2".
4. Thermometers for water shall have brass or steel separable socket. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.
5. Acceptable Manufacturer: Marsh, Miljoco, Trerice, Weiss, Weksler, Wika.

- B. Select scales to cover expected range of temperatures.

2.4 TEST PLUGS

- A. Test Plug: 1/4" or 1/2" brass fitting and cap, with Nordel core for temperatures up to 275°F, for receiving 1/8" outside diameter pressure or temperature probe. Plugs shall be rated for zero leakage from vacuum to 500 psi.
- B. Provide extended units for all plugs installed in insulated piping.
- C. Test Kit: Carrying case, internally padded and fitted containing one 3-1/2" diameter pressure gauge with 0-100 psi range, one gauge adapter with 1/8" probes, two 1-1/2" dial thermometers with 0° to 220°F and -25°F to 125°F ranges and 5" stems.
- D. Acceptable Manufacturers: Sisco, Flow Design, Peterson Equipment, MG Piping Products Co., Miljoco, Trerice, Watts Regulator.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 1. Install per manufacturer's instructions.
 2. Coil and conceal excess capillary on remote element instruments.
 3. Install gauges and thermometers in locations where they are easily read from normal operating level.
 4. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.
- B. Pressure Gauges:
 1. Connect pressure gauges to suction and discharge side of all pumps.
 2. Provide snubber for each pressure gauge.
 3. Provide coil syphon for each pressure gauge connected to steam piping.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

C. Thermometers:

1. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2" for installation of thermometer sockets.
2. Install thermometer sockets adjacent to control system thermostat, transmitter and sensor sockets.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Domestic Water Piping System.
- D. Sanitary Drainage and Vent Piping System.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- D. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- E. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- F. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- G. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- H. ANSI/ASTM B32 - Solder Metal.
- I. ANSI/AWS D1.1 - Structural Welding Code.
- J. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- K. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- L. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- M. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.
- N. ASME - Boiler and Pressure Vessel Code.
- O. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- Q. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
- R. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- S. ASTM A312 - Standard for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- T. ASTM A554 - Standard for Welded Stainless Steel Mechanical Tubing.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- U. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- V. ASTM B88 - Seamless Copper Water Tube.
- W. ASTM B306 - Copper Drainage Tube (DWV).
- X. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- Y. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- Z. AWS A5.8 - Brazed Filler Metal.
- AA. AWWA C651 - Disinfecting Water Mains.
- BB. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- CC. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- DD. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
- EE. NFPA 24 - Private Fire Service Mains and Their Appurtenances.
- FF. NSF - National Sanitation Foundation

1.4 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

1.6 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

**2.1 COLD WATER - POTABLE AND NON-POTABLE
HOT WATER - POTABLE AND NON-POTABLE**

- A. Design Pressure: 175 psi.
Maximum Design Temperature: 200°F.
- B. Piping - All Sizes:
 - 1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
 - 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
- C. Shutoff Valves:
 - 1. Butterfly Valves:
 - a. BF-1:
 - 1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.

2. Ball Valves:

a. BA-1:

- 1) 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

NOTES:

- a) Provide extended shaft for all valves in insulated piping.
- b) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

D. Throttling/Shutoff Valves:

1. Globe Valves:

- a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.
- b. GL-2: 2-1/2" thru 10", 125# steam @ 353°F, 200# CWP @ 150°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

E. Check Valves:

1. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.
2. CK-14: 2-1/2" thru 12", 200# CWP, double disc wafer type, bronze or iron body, bronze trim, metal-to-metal or Viton seat, 316 SS shaft, Inconel 600 spring. Mission Duo Chek #12HPP (with Inconel springs), Mueller Steam Specialty Co. #71-AHB-K-W, Stockham #WG-961-EPDM or #WG-970-BUNA, Nibco w-920-W.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

F. Strainers:

1. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.
2. ST-7: 2-1/2" thru 8", bronze body, flanged ends, flanged cover, 150# steam, 225# CWP. Mueller Steam Specialty Co. #851.

2.2 SANITARY DRAINAGE (ABOVE GROUND)
SANITARY INDIRECT DRAINAGE (ABOVE GROUND)
SANITARY VENT (ABOVE GROUND)

A. Design Pressure: Gravity
Maximum Design Temperature: 180°F

B. Piping - 1-1/2" through 15":

1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
2. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 3011. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

C. Vent Flashing: Flash vents with premolded EPDM pipe flashing cones for single-ply membrane roofs.

2.3 SANITARY DRAINAGE (BELOW GROUND - INSIDE BUILDING)
SANITARY VENT (BELOW GROUND - INSIDE BUILDING)

A. Design Pressure: Gravity
Maximum Design Temperature: 180°F

B. Piping - 1-1/2" through 15":

1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
2. Joints: Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300

Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.4 SANITARY DRAINAGE (BELOW GROUND - OUTSIDE OF BUILDING)

- A. Design Pressure: Gravity
Maximum Design Temperature: 160°F
- B. Piping - 1-1/2" through 15":
 - 1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark
 - 2. Joints: Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 - 3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.5 CONDENSATE DRAINAGE

- A. Design Pressure: Gravity
- B. Piping: Same as specified for Sanitary Drainage (Above Ground).

2.6 LOCK OUT TRIM

- A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F, in compressed air piping, and as indicated on the drawings.

2.7 VALVE OPERATORS

- A. Provide handwheels for gate valves and gear operators for butterfly valves.

2.8 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Connect to equipment with flanges or unions.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.
- F. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Architect, Engineer, and Owner before proceeding with work so any necessary rework can take place if needed.

3.2 TESTING PIPING

- A. Sanitary Drainage:
Sanitary Vent:
 - 1. Test all piping with water to prove tight.
 - 2. Test piping before insulation is applied.
 - 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
 - 4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
 - 5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
 - 6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
 - 7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
 - 8. Test piping per CPC requirements
- B. Fire Service:
 - 1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:
 - a. Interior Piping: 0 quarts per hour.
 - b. Underground Piping: 2 quarts per 100 joints per hour.
- C. All Other Piping:
 - 1. Test piping at 150% of normal operating pressure.
 - 2. Piping shall hold this pressure for one hour with no drop in pressure.
 - 3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
 - 4. Drain and clean all piping after testing is complete.
 - 5. Test compressed air piping per ASME 31.9 requirements

3.3 CLEANING PIPING

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. All Water Piping:

1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
3. If necessary, remove valves to clean out all foreign material.

C. Fire Service:

1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
 - a. 390 gpm for 4" pipes.
 - b. 880 gpm for 6" pipes.

3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.

B. Installation Requirements In Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.
4. Install valve stems upright or horizontal, not inverted.
5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.

D. Underground Piping:

1. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.
2. For all underground piping, provide a foundation (the layer below the bedding) if the trench bottom is unstable. Lay underground plastic piping on 4" to 6" of sand bedding. When the trench is in rock, lay underground metallic piping on 6" of sand bedding. Provide recessed areas for pipe bells and joints. After joints are made, any misalignment in elevation shall be corrected by tamping sand around the pipe. Backfill with sand in uniform layers not over 6" deep to the spring line of all underground pipes, and carefully compact each layer to 90 percent Standard Proctor density. Backfill with sand up to 6" above pipe for landscaped areas. Remaining backfill may be soil. Under paving and buildings, the remaining backfill shall be sand and compacted to 98 percent Standard Proctor density.
3. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
5. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
6. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary and Storm Piping:

1. Install all sanitary piping inside the building with a slope of at least the following:

<u>Pipe Size</u>	<u>Minimum Slope</u>
3" and under	- 0.25" per foot
4" and over	- 0.125" per foot

- a. All sanitary systems transporting grease laden waste shall be sloped a minimum of 0.25" per foot regardless of size.
2. Install all storm piping inside the building with a slope of at least 0.125" per foot unless noted otherwise.
3. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
4. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 3 feet per second.
5. All sanitary and storm piping shall have at least 42" of cover when leaving the building.
6. Starter fittings with internal baffles are not permitted.

3.5 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

3.6 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water and compressed air lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.
- E. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- F. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- G. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- H. All vent and drain piping shall be of same materials and construction for the service involved.

3.7 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- E. In no case shall the vent through the roof be less than 4" in diameter.
- F. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake or exhaust opening on the roof.

3.8 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
 - 1. Domestic water piping above grade.
- E. Further limit use of mechanically formed fittings as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be type K or L copper tubing.
 - 3. Permanent marking shall indicate insertion depth and orientation.
 - 4. Branch pipe shall conform to the inner curve of the piping main.
 - 5. Main must be 1" or larger.
 - 6. Branch must be 3/4" or larger.
- F. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- G. Forged weld-on fittings are limited as follows:
1. Must have at least same pressure rating as the main.
 2. Main must be 2-1/2" or larger.
 3. Branch line is at least two pipe sizes under main size.

3.9 JOINING OF PIPE

A. Threaded Joints:

1. Threads shall conform to ANSI B2.1 "Pipe Threads".
2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
3. Protect plated pipe and valve bodies from wrench marks when making up joints.
4. Apply thread lubricant to male threads as follows:

Vents and Roof Conductors:	Red graphite
All Other Services:	Teflon tape

B. Flanged Joints:

1. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanged and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.
2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
3. Set flange bolts beyond finger tightness with a torque wrench for equal tension in all bolts. Tighten bolts so those 180° apart are torqued in sequence.
4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
 - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
 - b. Maximum pressure rating of at least 250 psig.
 - c. Minimum temperature rating: -10°F.
 - d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Solder Joints:

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.

2. Flux shall be non-acid type.
3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

D. Brazed Joints:

1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BAg-1 or BAg-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing. Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.
2. Remove discs from solder end valves during brazing.

E. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless mandatory local codes take precedence.
2. Furnish to the Owner's Representative prior to start of work certificates qualifying each welder.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.
5. Single-welded butt joints may be employed with or without the use of backing rings in all sizes. Where backing rings are not used on pumped pressurized systems, the root side of the weld shall either be chipped or ground flush with the piping wall. For services such as vents, overflows, and gravity drains, the backing ring may be eliminated, and the root of the weld need not be chipped or ground. Backing rings shall be of the material being welded.

F. Elastomeric Gaskets (Sanitary and Storm Pipe):

1. Hub and spigot pipe joints with elastomeric gaskets shall be made in accordance with the manufacturer's installation instructions.

G. Sleeve Gaskets (No-Hub) (Sanitary and Storm Pipe):

1. Gasket shall be heavy weight class, conforming to ASTM C564.
2. The gasket shall have an internal center stop.
3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.

4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.
- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- F. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- G. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.
- H. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.
- I. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.
- J. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.
- K. Disinfection shall comply with CPC - 609.9: Disinfection of Potable Water Systems

END OF SECTION

SECTION 22 10 30
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Floor Drains.
- B. Cleanouts.
- C. Traps.
- D. Trap Seals and Primers.
- E. Strainers.
- F. Unions.
- G. Balancing Valves.
- H. Water Hammer Arresters.
- I. Dielectric Fittings (Connections Between Dissimilar Metals).
- J. Air Vents.
- K. Drain Valves.
- L. Relief Valves.

1.2 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.

1.3 REFERENCES

- A. ANSI A112.21.1 - Floor Drains.
- B. ASSE 1010 - Water Hammer Arresters.
- C. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- D. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- E. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.
- F. PDI WH-201 - Water Hammer Arresters.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 YARD CLEANOUTS

- A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.
- B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

2.3 TRAPS

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:
 - 1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.
 - 2. Insulated at accessible lavatories.
 - 3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
 - 4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.
- B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.
- C. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water and a 1/2" minimum layer of mineral oil.

2.4 TRAP SEALS AND PRIMERS

- A. Provide trap seals as specified on the drawings.
- B. Provide trap primers as shown and specified on the drawings.

2.5 FLOOR DRAINS AND SINKS

- A. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.6 BACKFLOW PREVENTERS

- A. Provide backflow preventers as shown and specified on the drawings as well as required by code.

2.7 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

Pipe Size	1/4" - 2"	2-1/2" - 10"	12" - 18"
air	1/32"	3/64"	1/16"
water	3/64"	1/16"	1/8"

- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.8 UNIONS

- A. Copper pipe - wrought copper fitting - ground joint.
- B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.
- C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

2.9 BALANCING VALVE

- A. Rated for 125 psi working pressure and 250°F operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1' and 2' water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.
- B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.
- C. Furnish one meter kit equivalent to Bell & Gossett Model RO-5 meeting the following requirements:
1. Carrying case with handle.
 2. Pressure gauge with 0-25 feet of head scale with 3.0% full scale accuracy.
 3. High and low side hoses with 5 feet length and 250 psig pressure rating, equipped with shutoff valves, vent valves, and probes for insertion into pressure and temperature plugs.
- D. Flow rate of 0.5 GPM or larger: Valves in copper piping shall be brass or bronze. Acceptable Manufacturers: Flow Design "Accusetter", Preso "B+", Armstrong "CVB", Bell & Gossett "Circuit Setter Plus", Griswold "Quickset", Gerand "Balvalve Venturi" or Nibco Globe Style balancing valve.
- E. Flow rate less than 0.5 GPM: Valves in copper piping shall be brass or bronze. Cv value shall be less than 1.0 when valve is completely open, and minimum balanceable flow rate shall not exceed 0.1 GPM with a meter reading of at least 2.5 feet. Acceptable manufacturers: Bell & Gossett "Circuit Setter RF", Flow Design, Preso, Armstrong, Griswold, Gerand, or Nibco balancing valve.

- F. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer's standard meters.

2.10 WATER HAMMER ARRESTERS

- A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.
- B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.
- C. Air chambers shall meet the requirements of the applicable plumbing code. Minimum 12" long at fixtures and minimum 24" long on risers. Air chambers shall be the same size or larger than the piping it is connected to.

2.11 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron, steel, and stainless steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.12 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

2.13 DRAIN VALVES

- A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

2.14 RELIEF VALVES

- A. RV-4: (Domestic Hot Water) Pressure and Temperature relief, cast bronze body and internal parts, stainless steel spring, test lever, threaded inlet and outlet. Maximum setting of 150 psi and 210°F temperature. Capacities ASME certified and labeled. Acceptable Manufacturers: Cash Series FV, Watts #40, #120, #N240, #340.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.
- C. Water Hammer Arresters and Air Chambers:
 1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
 2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.
 3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.
 4. Install air chambers at each fixture not protected by a water hammer arrester.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

D. Cleanouts:

1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet in pipe less than 6" size and 100 feet apart in 6" and larger pipes inside the building.
2. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
3. Extend cleanouts to the floor with long sweep elbows.
4. Install a full size, two-way cleanout within 5 feet of the foundation inside of building.
5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

E. Yard Cleanouts:

1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.

F. Trap Seals and Primers:

1. Install trap guard on drains not receiving continuous discharge and subject to drying out.

G. Floor Drains and Sinks:

1. Coordinate sloping requirements with the architectural plans and specifications.
2. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.

H. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

END OF SECTION

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Domestic Water In-Line Circulators.

1.2 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Pumps with motors operating above the RPM the pump curves are based on shall have impellers trimmed to deliver GPM and head scheduled.
- D. Submit certification that pumps, accessories, and components will withstand seismic forces defined in Section 22 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Statically and dynamically balance rotating parts.
- B. Construction shall permit complete servicing without breaking piping or motor connections.
- C. Pumps shall operate at 1750 rpm unless specified otherwise.
- D. Pump connections shall be flanged, whenever available.
- E. Domestic hot water pumps shall be suitable for 225°F water.
- F. Motors shall comply with Section 22 05 13.

- G. Submitted pump selections must have a diameter impeller that meets or exceeds the scheduled pump. The inlet and discharge pipe sizes shall also meet or exceed the scheduled pump.

2.2 DOMESTIC WATER IN-LINE CIRCULATORS

- A. Provide pumps as specified on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install all products per manufacturer's recommendations.
 - 2. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. In-Line Pump:
 - 1. Support in-line pumps individually so there is no strain on the piping. Support pump so no weight is carried on pump casings. Install with a minimum of five diameters of straight pipe on pump suction and discharge.
 - 2. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
 - 3. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.
- C. Pump without VFD:
 - 1. For pumps not powered by a VFD, trim impeller to meet maximum operating conditions. Coordinate final trimmed diameter with Testing, Adjusting, and Balancing Contractor.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters.
- B. Water Softeners.
- C. Pressure Booster System.

1.2 QUALITY ASSURANCE

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
 - 1. American Gas Association (AGA).
 - 2. National Sanitation Foundation (NSF).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - 5. National Electrical Manufacturers' Association (NEMA).
 - 6. Underwriters' Laboratories (UL).
- B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.
- C. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.
- D. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASME Section 8D - Pressure Vessels.
- C. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- F. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.
- G. UL 174 - Household Electric Storage Tank Water Heaters.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- D. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- E. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- F. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.
- G. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- H. Submit certification that water heaters, water softeners, pressure booster system, accessories, and components will withstand seismic forces defined in Section 22 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- I. Submit a current water analysis from the actual water source serving the project site for softening equipment verification before sending shop drawings to the Architect/Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 REGULATORY REQUIREMENTS

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.
- C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

PART 2 - PRODUCTS

2.1 WATER HEATERS

- A. All water heaters shall be as scheduled on the drawings.

2.2 PRESSURE BOOSTER SYSTEMS

- A. Packaged pressure boosting system shall be completely factory assembled, run-tested, and shipped to site as an integral unit assembled on a steel skid including pumps,

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

motors, valves, Type "L" copper or stainless steel suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with Logic and power controls. Size and capacity shall be as scheduled on the drawings.

- B. Shutoff valves shall be provided on the suction and discharge of each pump. Silent spring- loaded check valves shall be installed on the discharge of each pump.
- C. Pressure gauges shall be provided on the front cover of the control panel indicating system suction and discharge pressure. Pressure gauges shall be 4-1/2 inch (15 mm) diameter, Grade 1A, having 1% total range span accuracy and installed with shutoff valve and pressure snubber at gauge connection to system piping. All skid-mounted components shall be factory finished with enamel paint. Individual pumps, motors, variable frequency drives, and check valves shall be serviceable with the booster system in operation, and all components shall be suitable for the maximum system working pressure.
- D. System shall include two vertical mounted pumps with ANSI flanged or NPT threaded connections, replaceable casing wear rings, and hydraulically balanced impellers. Pumps shall be cast iron, bronze or stainless steel fitted construction with replaceable shaft sleeves and mechanical seals suitable for 175 psig (1,207 kPa) working pressure.
- E. Pressure regulating valves to control system pressure at the unit are not allowed per ASHRAE 90.1.
- F. Each pump shall include a pressure relief valve, set to relieve 15 psi (103 kPa) above the high limit pressure switch setting, which shall be piped to a floor drain by the installing contractor.
- G. Provide each pump with a premium efficient open drip-proof motor labeled for use with variable frequency drives (VFDs) and sized for operation at any point of the pump curve, including pump run-out (non-overloading operation).
- H. Provide and mount on the system skid two VFDs suitable for variable torque applications. Minimum acceptable VFD full load/full speed efficiency shall be 97%, with a fundamental power factor of 0.98. VFDs shall meet the following:
 - 1. Pulse width modulated (PWM).
 - 2. Starts into rotating load.
 - 3. Overcurrent protection.
 - 4. Adjustable carrier switching frequency of up to 8 kHz.
 - 5. Keypad operator device or touchscreen that includes the following:
 - a. 2-line backlit display.
 - b. Power on and alarm/fault indicators
 - c. Hand-Off-Auto switch on VFD front panel cover
 - d. When switched to "Auto" operation, the VFDs shall follow the signal from the control panel logic section.
 - e. When switched to "Hand", the VFD speed is determined by the setting of the manual speed adjustment located on the VFD front panel cover.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

- f. Automatic VFD shutdown for electrical fault
- g. Automatic restart after electrical power is restored from a loss of power
- h. Service diagnostics with fault history log.
- I. Provide a high limit pressure switch compatible with the system controls, temperature, and pressure requirements. The pressure switch shall be mounted and wired on the control panel, with sensing line connected to the system discharge manifold. The high limit pressure switch shall shut down the system if the system pressure is more than 30 psi (207 kPa) above the normal operating pressure.
- J. Provide a pressure sensor/transmitter, shipped loose for field installation, that provides a modulating output compatible with the system controls. The pressure sensor/transmitter shall be used to control booster pump VFDs to maintain a constant system pressure.
- K. Provide a factory-mounted pressure sensor/transmitter in the discharge header that provides a modulating output compatible with the system controls. The pressure sensor/transmitter shall be used to control booster pump VFDs to maintain a constant system pressure. Control logic shall be capable of adjusting the pressure setpoint using a system pressure drop algorithm based on real-time flow data.
- L. Use of a single pressure sensor/transmitter to control system pressure and high limit pressure cutoff is not acceptable. Both the high limit pressure switch and the pressure sensor/transmitter shall be separately wired back to the booster pump control panel.
- M. The lead pump shall run only as necessary to maintain system pressure and will be automatically controlled by means of a pressure sensor/transmitter and control programming to prevent short cycling.
- N. If the lead pump is unable to maintain system pressure at the pressure sensor/transmitter, the lag pump will be called on after a time delay and will operate in parallel with the lead pump in accordance with control programming. When a low or no-flow condition is reached, the controls will shut down the lag pump if running and accelerate the lead pump to charge the system and hydro-pneumatic tank to 20 psi above normal operating pressure, then shut the lead pump down and alternate. Should any pump fail to operate, the next pump in sequence shall start automatically.
- O. Provide, mount and wire on the skid a programmable logic controller in a NEMA 1 enclosure. The controller shall interface the signals from the sensors to the VFDs and shall provide a stabilized response to speed up or slow down the pump or add additional pumps to meet system requirements. The controller shall provide setpoint control that can be changed by a keypad entry on the control faceplate. The controller shall have an alpha/numeric display, PID functions and both system and controller self-diagnostics. Controller shall be provided with dual function PID loop for startup mode and normal operation. Startup mode shall provide a quick response from shutdown and normal operation is tuned to eliminate hunting. Controller shall have a real-time calendar/clock and memory transfer cartridge.
- P. Provide a UL listed control panel in a NEMA 1 enclosure, factory mounted and wired on the steel skid. The panel shall be furnished with individual pump disconnects with through-the-door handles, pump run lights, H-O-A selector switches, 120-volt fused control transformer, and necessary relays, timers and a programmable controller with pump start, stop and sequence controls.
- Q. The controller shall be capable of outputting system pressure and a general alarm signal

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

to the building automation system.

- R. Non-mercury low pressure control to stop pump operation if incoming water pressure drops to atmospheric.
- S. Size and capacity shall be as scheduled on the drawings.
- T. Manufacturers:
 - 1. Xylem B&G
 - 2. Grundfos
 - 3. Goulds
 - 4. Metropolitan
 - 5. HYFAB
 - 6. Quantum Flo
 - 7. or approved equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all items in accordance with manufacturer's instructions.

3.2 WATER HEATER INSTALLATION

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 05 29.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.

3.3 PRESSURE BOOSTER INSTALLATION

- A. Provide startup by factory authorized start-up technician.
- B. Mount pressure sensor/transmitter used to control pressure booster pump VFDs remote from booster pump skid near the most remote critical plumbing fixture as indicated on the drawings, and wire signal directly back to pressure booster control panel. Pressure sensor/transmitter signal shall not interface with or be transmitted across any building information system network. Provide signal amplifiers or repeaters as required to ensure proper control operation.
- C. Provide four (4) hours of instruction and orientation to the Owner's maintenance staff by factory trained personnel. System walk-through, including programming of any system

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

controllers, shall be included in the training.

- D. Support piping adjacent to pumps so that no weight is carried by pump casings. Provide supports under elbows on 4" and larger.
- E. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
- F. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.
- G. Unless otherwise shown on the drawings, mount all pump skids on 4" high concrete pads and anchor frames to pads with cast-in-place anchors.
- H. All pump skids shall be grouted in. Follow manufacturer's instructions for grouting.
- I. Install on vibration isolators as scheduled on drawings.
- J. Coordinate installation to ensure manufacturer's recommended service clearances are met.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All plumbing fixtures.

1.2 REFERENCES

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- E. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- F. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- G. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- H. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- I. ASSE 1002 - Water Closet Flush Tank Ball Cocks.
- J. Americans with Disabilities Act (ADA), Title III.
- K. The Energy Policy Act (EPA) of 2005.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wall Hung Fixture Carriers:
 - 1. Material: All Metal, ASME/ANSI A112.6.1M.
 - 2. Acceptable Manufacturers: Zurn, Smith, Wade, Josam, Watts, Mifab.
 - 3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings.
- B. All fixtures shall be as scheduled on the drawings.
- C. All china shall be from the same manufacturer where possible.
- D. All lavatory and sink trim shall be from the same manufacturer where possible.

- E. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.
4. Install components level and plumb.
5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
7. Refer to Plumbing Material List for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.
2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.

STATE TECHNICAL COLLEGE OF MISSOURI
UTILITY TECHNICIAN CENTER PHASE B #21-626

3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
 4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.
- E. ADA Accessible Exposed Sink and Lavatory Trim:
1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.
- F. ADA Accessible Water Closet Requirements:
1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
 2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

3.2 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION