



PROJECT MANUAL

Construct New Fitness Center Ike Skelton Training Site Jefferson City, Missouri

Designed By: Klingner & Associates, P.C.
907 East Ash
Columbia, MO 65201

Date Issued: 7/29/2022

Project No.: T2041-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: T2041-01

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:



Cody N. Basham, Architect
AIA-2021000203
Project Manual Division 03, 04, 06, 07, 08, 09,
10, and 12



Nathan R. Marold, Engineer
PE-2022017792
Project Manual Division 03 and 13



Curt Wavering, Engineer
PE-2011009046
Project Manual Division 02, 31, 32, and 33



Matthew H. Bridges, Engineer
PE-2021031578
Project Manual Division 00, 01, 21, 22, 23, 26,
and 27, 28

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

SECTION	TITLE	NUMBER OF PAGES
DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION		
000000	INTRODUCTORY INFORMATION	
000101	Project Manual Cover	1
000107	Professional Seals and Certifications	1
000110	Table of Contents	3
000115	List of Drawings	3
001116	INVITATION FOR BID (IFB) plus Missouri Buys instructions and special notice	3
002113	INSTRUCTIONS TO BIDDERS (Includes MBE/WBE/SDVE Information)	8
003144	MBE/WBE/SDVE Directory	1
The following documents may be found on MissouriBUYS at https://missouribuy.mo.gov		
004000	PROCUREMENT FORMS & SUPPLEMENTS	
004113	Bid Form	*
004336	Proposed Subcontractors Form	*
004337	MBE/WBE/SDVE Compliance Evaluation Form	*
004338	MBE/WBE/SDVE Eligibility Determination Form for Joint Ventures	*
004339	MBE/WBE/SDVE Good Faith Effort (GFE) Determination Forms	*
004340	SDVE Business Form	*
004541	Affidavit of Work Authorization	*
004545	Anti-Discrimination Against Israel Act Certification form	*
005000	CONTRACTING FORMS AND SUPPLEMENTS	
005213	Construction Contract	3
005414	Affidavit for Affirmative Action	1
006000	PROJECT FORMS	
006113	Performance and Payment Bond	2
006325	Product Substitution Request	2
006519.16	Final Receipt of Payment and Release Form	1
006519.18	MBE/WBE/SDVE Progress Report	1
006519.21	Affidavit of Compliance with Prevailing Wage Law	1
007000	CONDITIONS OF THE CONTRACT	
007213	General Conditions	20
007300	Supplementary Conditions	2
007333	Supplementary General Conditions for Federally Funded Projects	20
007346	Wage Rate (State and Davis-Bacon Act Wage Determination)	10
DIVISION 1 – GENERAL REQUIREMENTS		
011000	Summary of Work	2
012100	Allowances	2
012300	Alternates	2
012600	Contract Modification Procedures	2
013100	Coordination	4
013115	Project Management Communications	3
013200	Schedules – Bar Chart	4
013300	Submittals	11
013513.28	Site Security and Health Requirements	4
015000	Construction Facilities and Temporary Controls	8
017400	Cleaning	3
DIVISION 02 – EXISTING CONDITIONS		
024120	Subsurface Conditions	2

DIVISION 03 – CONCRETE		
031000	Concrete Forming and Accessories	8
032000	Concrete Reinforcing	6
033000	Cast-In-Place Concrete	11
033543	Special Concrete Floor Finishes	6
DIVISION 04 – MASONRY		
042000	Unit Masonry	11
DIVISION 06 – WOODS, PLASTICS, AND COMPOSITES		
061000	Rough Carpentry	5
066140	Solid Surfacing	4
DIVISION 07 – THERMAL AND MOISTURE PROTECTION		
079200	Joint Sealants	5
DIVISION 08 – OPENINGS		
081100	Metal Door Frames	3
081300	Metal Doors	3
084113	Aluminum-Framed Entrances and Storefronts	6
087100	Door Hardware	19
088000	Glazing	7
DIVISION 09 – FINISHES		
092216	Non-Structural Metal Framing	2
092900	Gypsum Board	5
095123	Acoustical Panel Ceilings	3
096450	Resilient Athletic Flooring	5
096519	Resilient Flooring	5
096723	Resinous Flooring	7
099123	Interior Painting	6
DIVISION 10 – SPECIALTIES		
102113	Solid Plastic Toilet Compartments	5
102600	Wall Protection	3
102800	Toilet and Shower Accessories	4
104414	Fire Extinguishers and Cabinets	2
DIVISION 12 – FURNISHINGS		
122100	Window Blinds	2
DIVISION 13 – SPECIAL CONSTRUCTION		
133419	Metal Building Systems	15
DIVISION 21 – FIRE SUPPRESSION		
211000	Water-Based Fire-Suppression System	12
DIVISION 22 – PLUMBING		
220500	Common Work Results for Plumbing	9
220519	Meters and Gages for Plumbing Piping	3
220523	General Duty Valves for Plumbing Piping	3
220529	Hangers and Supports for Plumbing Piping and Equipment	8
220553	Identification for Plumbing and Equipment	2
220700	Plumbing Insulation	6
221116	Domestic Water Piping	5
221316	Sanitary Waste and Vent Piping	5
221119	Domestic Water Piping Specialties	5
221319	Sanitary Waste Piping Specialties	5
223400	Fuel Fired Domestic Water Heaters	4

224000	Plumbing Fixtures	3
224700	Drinking Fountains and Water Coolers	3
225000	Facility Natural Gas Piping	6
DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING		
230500	Common Work Results for HVAC	3
230553	Identification for HVAC Piping and Equipment	3
230593	Testing, Adjusting and Balancing for HVAC	4
230700	HVAC Insulation	10
230900	Instrumentation and Control for HVAC	8
232301	VRV\VRF Refrigeration Piping	5
233113	Metal Ducts	7
233300	Air Duct Accessories	6
233713	Diffusers, Registers, and Grilles	2
237200	Air-To-Air Energy Recovery Equipment	3
238200	Variable Refrigerant Flow HVAC Systems	10
238216	Air Coils	2
239100	Louvers	3
DIVISION 26 – ELECTRICAL		
260500	Common Work Results for Electrical	3
260519	Low Voltage Electrical Power Conductors and Cables	3
260526	Grounding and Bonding for Electrical Systems	4
260529	Hangers and Supports for Electrical Systems	3
260533	Raceway and boxes for Electrical Systems	7
260553	Identification for Electrical Systems	5
260923	Lighting Control Devices	3
262416	Panelboards	4
262726	Wiring Devices	5
262816	Enclosed Switches and Circuit Breakers	3
265100	Interior Lighting	3
DIVISION 27 – COMMUNICATIONS		
271500	Communications Horizontal Cabling	7
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY		
283111	Digital, Addressable Fire-Alarm System	6
DIVISION 31 – EARTHWORK		
310516	Aggregates for Earthwork	2
311000	Site Clearing	4
312300	Excavation and Fill	12
312313	Subgrade Preparation	1
312333	Trenching and Backfilling	4
312513	Erosion Control	8
DIVISION 32 – EXTERIOR IMPROVEMENTS		
321123	Aggregate Base Courses	2
321313	Concrete Paving	7
329219	Seeding	8
329300	Landscaping	7
DIVISION 33 - UTILITIES		
331110	Site Water Distribution	4
334100	Storm Utility Drainage Piping	3
334101	Sanitary Sewerage System	16
APPENDIX A – GEOTECHNICAL INVESTIGATION		21

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

- A. The following list of drawings is a part of the Bid Documents:

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>	<u>CAD #</u>
1.	COVER SHEET	G001	07/29/2022	G001
2.	INDEX SHEET	G002	07/29/2022	G002
3.	CODE PLAN & REVIEW	G101	07/29/2022	G101
4.	GENERAL NOTES & LEGENDS	C001	07/29/2022	C001
5.	EXISTING CONDITIONS & SITE DEMO PLAN	CD101	07/29/2022	CD101
6.	SITE PLAN	C101	07/29/2022	C101
7.	SITE UTILITY PLAN	C102	07/29/2022	C102
8.	GRADING & EROSION CONTROL PLAN BASE BID	C103	07/29/2022	C103
9.	GRADING & EROSION CONTROL PLAN ALTERNATE BID #4	C103A	07/29/2022	C103A
10.	SITE DETAILS	C501	07/29/2022	C501
11.	SITE DETAILS	C502	07/29/2022	C502
12.	SITE DETAILS	C503	07/29/2022	C503
13.	SITE DETAILS	C504	07/29/2022	C504
14.	PARTITION TYPES AND ADA CLEARANCES	A001	07/29/2022	A001
15.	FLOOR PLAN	A101	07/29/2022	A101
16.	DIMENSION PLANS	A102	07/29/2022	A102
17.	ENLARGED PLANS	A103	07/29/2022	A103

18.	INTERIOR FINISH PLAN	A110	07/29/2022	A110
19.	ROOF PLAN & REFLECTED CEILING PLAN	A130	07/29/2022	A130
20.	BUILDING ELEVATIONS – BASE BID	A201	07/29/2022	A201
21.	BUILDING ELEVATIONS – ALTERNATE 1	A202	07/29/2022	A202
22.	BUILDING SECTIONS	A301	07/29/2022	A301
23.	WALL SECTIONS	A310	07/29/2022	A310
24.	EQUIPMENT LAYOUT & SCHEDULE	A401	07/29/2022	A401
25.	DETAILS	A501	07/29/2022	A501
26.	DOOR SCHEDULE & DETAILS	A601	07/29/2022	A601
27.	STRUCTURAL NOTES	S001	07/29/2022	S001
28.	FOUNDATION PLAN & DETAILS	S101	07/29/2022	S101
29.	FOUNDATION DETAILS	S102	07/29/2022	S102
30.	MEP SYMBOLS LIST	MEP001	07/29/2022	MEP001
31.	FIRE PROTECTION FLOOR PLAN	FP101	07/29/2022	FP101
32.	BELOW FLOOR PLUMBING PLAN	P101	07/29/2022	P101
33.	ABOVE FLOOR PLUMBING PLAN	P102	07/29/2022	P102
34.	PLUMBING DETAILS	P501	07/29/2022	P501
35.	PLUMBING SCHEDULES	P601	07/29/2022	P601
36.	ISOMETRIC WASTE AND VENT PLUMBING VIEW	P901	07/29/2022	P901
37.	MECHANICAL FLOOR PLAN	M101	07/29/2022	M101
38.	MECHANICAL PIPING PLAN	M102	07/29/2022	M102
39.	HVAC AIRFLOW SCHEMATICS	M401	07/29/2022	M401
40.	MECHANICAL DETAILS	M501	07/29/2022	M501
41.	MECHANICAL EQUIPMENT SCHEDULES	M601	07/29/2022	M601
42.	CONTROL SCHEMATICS & SEQUENCES	M701	07/29/2022	M701
43.	CONTROL SCHEMATICS & SEQUENCES	M702	07/29/2022	M702
44.	ELECTRICAL POWER PLAN	E101	07/29/2022	E101
45.	ELECTRICAL LIGHTING PLAN	E102	07/29/2022	E102
46.	ELECTRICAL DETAILS	E501	07/29/2022	E501

END OF SECTION 000115

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

- A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

- A. Construct New Fitness Center
Ike Skelton Training Site
Jefferson City, Missouri
Project No.: T2041-01

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, Thursday, August 25, 2022
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuy.mo.gov>. Bidder must be registered to bid.**

4.0 DESCRIPTION:

- A. Scope: The Work consists of construction of a new fitness center at the Ike Skelton Training Site.
- B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**
- C. ****NOTE:** Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.
- D. In addition to the State of Missouri MBE/WBE/SDVE participation goals set forth herein and in the bid documents for this project, the contractor on a federally funded/assisted construction project is subject to federal Executive Order 11246. The Bidder's attention is drawn to the Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity (Executive Order 11246, 41 C.F.R. 60-4.2) in Section 007333, SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS, which is incorporated by reference.

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, Thursday, August 11, 2022, at 6819A North Boundary Rd, Jefferson City, MO.
- B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

- A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of \$100 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, <https://www.adsplanroom.net>. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**
- B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**
- C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

7.0 POINT OF CONTACT:

- A. Designer: Klingner & Associates, P.C., John Neyens, (573) 355-5988, email: jjn@klingner.com
- B. Project Manager: Jared Cook, (573) 690-6733, email: jared.cook2@oa.mo.gov

8.0 GENERAL INFORMATION:

- A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.
- B. Bid results will be available at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> after it is verified that at least one bid is awardable and affordable.
- C. This is a federally funded/assisted construction project that requires compliance by the awarded contractor with applicable federal laws and regulations. The Bidder should review Section 007333, SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS, which is made part of this solicitation and will be made part of the resulting contract by reference.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

- A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to <https://missouribuy.mo.gov> and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.
- B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations."
 2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
 3. Select "Active Solicitations" tab.
 4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.
- C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
 2. Select the three dots under "Actions." Select "Add New Response."
 3. When the Quote box opens, give the response a title and select "OK."
 4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
 5. The Supplier Attachments box will open. Select "Add Attachment" again.
 6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
 7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
 8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
 9. The detailed solicitation will open. At the bottom select "Close."
- D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov ; April Howser: 573-751-0053, April.Howser@oa.mo.gov ; or Mandy Roberson: 573-522-0074, Mandy.Roberson@oa.mo.gov.
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO
BIDDERS: Article 15.0, Section D1:

As of July 1, 2020, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

- A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.
- B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

- A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

3.0 - BIDDERS' OBLIGATIONS

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.
- B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

- A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.
- B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.
- C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.
- D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

- A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

- B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.
- C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.
- D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

- A. A bid from an individual shall be signed as noted on the Bid Form.
- B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.
- C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

- E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.
- F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.
- B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (<https://www.missouribuy.com/>) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.
- C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (<https://www.missouribuy.com/>), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.
- D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.
- E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.
- F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.
- G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.
- B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

- A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.
- B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

- C. In awarding the contract the Owner may take into consideration the bidder's skill, facilities, capacity, experience, responsibility, previous work record, financial standing and the necessity of prompt and efficient completion of work herein described. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of his bid. However, no contract will be awarded to any individual, partnership or corporation, who has had a contract with the State of Missouri declared in default within the preceding twelve months.
- D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the low bidder.
- E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

- A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

- A. If required by "Section 004113 – Bid Form," each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder's firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact

clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

- A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:
 - 1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

- A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.
- B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.
- C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. Pursuant to section 34.600, RSMo, if the Bidder meets the section 34.600, RSMo, definition of a “company” and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel as defined in section 34.600, RSMo, and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

- A. Definitions:
 - 1. “**MBE**” means a Minority Business Enterprise.
 - 2. “**MINORITY**” has the same meaning as set forth in 1 C.S.R. 10-17.010.
 - 3. “**MINORITY BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 4. “**WBE**” means a Women’s Business Enterprise.
 - 5. “**WOMEN’S BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
 - 6. “**SDVE**” means a Service-Disabled Veterans Enterprise.
 - 7. “**SERVICE-DISABLED VETERAN**” has the same meaning as set forth in section 34.074, RSMo.

8. **“SERVICE-DISABLED VETERAN ENTERPRISE”** has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than \$100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.
3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder’s proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.
4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder’s bid. Based on this calculation, if the eligible SDVE’s evaluation is less than the apparent low responsive bidder’s bid, the eligible SDVE’s bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.
4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder’s MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work

and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (<https://apps1.mo.gov/MWBCertifiedFirms/>). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (<https://oa.mo.gov/sites/default/files/sdvelisting.pdf>) or the Department of Veterans Affairs' directory (<https://vetbiz.va.gov/basic-search/>).
3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
 - a. The amount of actual participation obtained;
 - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
 - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
 - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
 - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
 - f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
 - g. The Bidder's stated reasons for rejecting any bids;
3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.
2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
 - a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or
 - b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.
3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

**STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION
*MBE/WBE/SDVE DIRECTORY***

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO). The current Directory can be accessed at the following web address:

<https://apps1.mo.gov/MWBCertifiedFirms/>

Please note that you may search by MBE, WBE, or both as well as by region, location of the business by city or state, as well as by commodity or service.

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directory (s) may be accessed at the following web addresses:

<https://oa.mo.gov/sites/default/files/sdvelisting.pdf>

<https://vetbiz.va.gov/basic-search/>

THIS PAGE INTENTIONALLY LEFT BLANK



State of Missouri Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the "**Owner**", represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the Department of Public Safety, Missouri National Guard.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name: **Construct New Fitness Center
Ike Skelton Training Site
Jefferson City, Missouri**

Project Number: **T2041-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **160 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of \$1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid:	\$
Alternate No. 1:	\$
Alternate No. 2:	\$
Alternate No. 3:	\$
Alternate No. 4:	\$

TOTAL CONTRACT AMOUNT: (\$CONTRACT AMOUNT)

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

DAVIS-BACON ACT: If this Project is financed in whole or in part from Federal funds (as indicated in the Instructions to Bidders or other bid or contract documents for this Project), then this contract shall be subject to all applicable federal labor statutes, rules and regulations, including provisions of the Davis-Bacon Act, 40 U.S.C. §3141 et seq., and the “Federal Labor Standards Provisions,” as further set forth in Section 007333 – Supplementary General Conditions for Federally Funded/Assisted Construction Projects, which is incorporated into the contract by reference. Where the Missouri Prevailing Wage Law and the Davis-Bacon Act require payment of different wages for work performed under this contract, the Contractor and all Subcontractors shall pay the greater of the wages required under either law, on a classification by classification basis.

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm:	Subcontract Amt:\$
MBE/WBE/SDVE Firm:	Subcontract Amt:\$
MBE/WBE/SDVE Firm:	Subcontract Amt:\$

Total \$

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
 - a. Invitation for Bid (Section 001116)
 - b. Instructions to Bidders (Section 002113)
 - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
 - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
 - i. Bid Form (Section 004113)
 - ii. Unit Prices (Section 004322)
 - iii. Proposed Contractors Form (Section 004336)
 - iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
 - v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
 - vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
 - vii. Missouri Service Disabled Veteran Business Form (Section 004340)
 - viii. Affidavit of Work Authorization (Section 004541)
 - ix. Affidavit for Affirmative Action (Section 005414)
 - e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
 - f. General Conditions (Section 007213)
 - g. Supplementary Conditions (Section 007300)
 - h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
 - i. Wage Rate(s) (Section 007346)
2. Division 1 – General Requirements
3. All Drawings identified in the Project Manual
4. All Technical Specifications included in the Project Manual
5. Addenda, if applicable

By signature below, the parties hereby execute this contract document.

APPROVED:

Dale Cassmeyer
Deputy Director of Planning, Design, & Construction
Division of Facilities Management,
Design and Construction

Contractor's Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

Corporate Secretary

THIS PAGE INTENTIONALLY LEFT BLANK



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the ☐ sole proprietor ☐ partner ☐ officer or ☐ manager or managing member of

NAME

a ☐ sole proprietorship ☐ partnership
☐ limited liability company (LLC)

or ☐ corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action
requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE

DATE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL

STATE OF

COUNTY (OR CITY OF ST.
LOUIS)

**USE RUBBER STAMP IN CLEAR AREA
BELOW**

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

NOTARY PUBLIC SIGNATURE

MY COMMISSION EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____
as principal, and _____
_____ as Surety, are held and firmly bound unto the
STATE OF MISSOURI. in the sum of _____ Dollars (\$))
for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly
and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____
day of _____, 20_____, enter into a contract with the State of Missouri for

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

- ☐ **SUBSTITUTION PRIOR TO BID OPENING**
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)
- ☐ **SUBSTITUTION FOLLOWING AWARD**
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

- ☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)
- ☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	
LOCATION		DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION	
DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?	
<input type="checkbox"/> YES <input type="checkbox"/> NO	
IF YES, EXPLAIN	
SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK	
<input type="checkbox"/> YES <input type="checkbox"/> NO	
BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:	
<p>We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.</p>	
BIDDER/CONTRACTOR	DATE
REVIEW AND ACTION	
<input type="checkbox"/> Resubmit Substitution Request with the following additional information:	
<input type="checkbox"/> Substitution is accepted.	
<input type="checkbox"/> Substitution is accepted with the following comments:	
<input type="checkbox"/> Substitution is not accepted.	
ARCHITECT/ENGINEER	DATE



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

THIS PAGE INTENTIONALLY LEFT BLANK



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

MBE/WBE/SDVE PROGRESS REPORT

Remit with ALL Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL <input type="checkbox"/> FINAL	DATE

PROJECT TITLE			
PROJECT LOCATION			
FIRM			
ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) \$		TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) \$	
THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$			
SELECT MBE, WBE, SDVE	TOTAL AMOUNT OF SUBCONTRACT	\$ AMOUNT PAID-TO-DATE	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

Revised 05/21

THIS PAGE INTENTIONALLY LEFT BLANK



STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____

State of _____ personally came and appeared _____

(NAME)

of the _____

(POSITION)

(NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 _____ in carrying out the contract and working in connection with _____

(NAME OF PROJECT)

Located at _____ in _____ County

(NAME OF THE INSTITUTION)

Missouri, and completed on the _____ day of _____ 20 _____

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER OR
BLACK INK RUBBER STAMP SEAL

STATE

COUNTY (OR CITY OF ST. LOUIS)

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

USE RUBBER STAMP IN CLEAR AREA BELOW

NOTARY PUBLIC SIGNATURE

MY COMMISSION
EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

FILE: Closeout Documents

THIS PAGE INTENTIONALLY LEFT BLANK

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

- 1.1. Definitions
- 1.2. Drawings and Specifications
- 1.3. Compliance with Laws, Permits, Regulations and Inspections
- 1.4. Nondiscrimination in Employment
- 1.5. Anti-Kickback
- 1.6. Patents and Royalties
- 1.7. Preference for American and Missouri Products and Services
- 1.8. Communications
- 1.9. Separate Contracts and Cooperation
- 1.10. Assignment of Contract
- 1.11. Indemnification
- 1.12. Disputes and Disagreements

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
- 3.4. Guaranty and Warranties
- 3.5. Operation and Maintenance Manuals
- 3.6. Other Contractor Responsibilities
- 3.7. Subcontracts

4. Changes in the Work

- 4.1. Changes in the Work
- 4.2. Changes in Completion Time

5. Construction and Completion

- 5.1. Construction Commencement
- 5.2. Project Construction
- 5.3. Project Completion
- 5.4. Payments

6. Bond and Insurance

6.1. Bond

6.2. Insurance

7. Termination or Suspension of Contract

7.1. For Site Conditions

7.2. For Cause

7.3. For Convenience

SECTION 007213 - GENERAL CONDITIONS

- A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.
- B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

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

- 1. **"COMMISSIONER"**: The Commissioner of the Office of Administration.
- 2. **"CONSTRUCTION DOCUMENTS"**: The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
- 3. **"CONSTRUCTION REPRESENTATIVE"**: Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
- 4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
- 5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
- 6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
- 7. **"DIVISION"**: Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.

- 8. **"INCIDENTAL JOB BURDENS"**: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
- 9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
- 10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri.
- 11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
- 12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
- 13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
- 14. **"WORK"**: Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
- 15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

- A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur,

architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.

- B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.
- C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.
- D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.
- E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action. If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.
- E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain

construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.

- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

- A. The Contractor and his subcontractors will not discriminate against individuals based on race,

color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

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

1. A written policy statement committing the total organization to affirmative action and

assigning management responsibilities and procedures for evaluation and dissemination;

2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

- C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

- A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright,

the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.
- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the

United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

- A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.
- B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.
- C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.
- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall

coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

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

ARTICLE 1.11 - INDEMNIFICATION

- A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.
- B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to

give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

- A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.
- B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.
- C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice. The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.
- D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility

for correcting such work without additional compensation.

- F. The Owner shall have the right to direct the Contractor to uncover any completed work.
 - 1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.
 - 2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.
- G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.
- H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.
- I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

- A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.
- B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.
- C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.
- D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.
- E. When a material has been approved, no change in brand or make will be permitted unless:
 - 1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or
 - 2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

- A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, = purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

- B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and

schedules submitted without this evidence will be returned to the Contractor for resubmission.

- C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.
- D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:
 - 1. It is in the best interest of the Owner
 - 2. It does not increase the contract sum and/or completion time
 - 3. It does not deviate from the design intent
 - 4. It is without prejudice to any and all rights under the surety bond.
- E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction
- F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

- A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract

changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

A. General Guaranty

- 1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
- 2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
- 3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.
- 4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer

period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name plate data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.
 - a. Recommended spare parts including catalog number and name of local supplier or factory representative.
 - b. Belt sizes, types, and lengths.
 - c. Wiring diagrams.
5. Manufacturer's Certificate of Warranty as described in Article 3.4.
6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.
2. The manuals shall identify project name, project number, and include the name and

address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 -- OTHER CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.
- B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.
- C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors

for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.
- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation

services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.
- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor

shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

- A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.
- B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.
- C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.
- D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by

altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon before such changes become effective and shall be determined, through submission of a request for proposal, as follows:
 - 1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
 - 2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
 - 3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.
- D. Overhead and Profit on Contract Changes shall be applied as follows:

- 1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools,

- warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be negotiated, and may vary according to the nature, extent, and complexity of the work involved. However, the overhead and profit for the Contractor or subcontractor actually performing the work shall not exceed 14%. When one or more tiers of subcontractors are used, in no event shall any Contractor or subcontractor receive as overhead and profit more than 3% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty percent (20%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.
 3. The Contractor will be allowed to add the cost of bonding and insurance to their cost of work. This bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.
 4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
 5. The percentage for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be negotiated, and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%). If the percentage for overhead and profit charged for work added by Contract Changes for this contract has been negotiated to less than 10%, the negotiated rate shall then apply to credits as well.
- E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The

Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

- F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.
- G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

- A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:
 1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
 2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
 3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.
- B. Extension of the number of work days stipulated in the Contract for completion of the work without compensation may be made when:
 1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
 2. Labor strikes or acts of God occur, OR
 3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.
- C. No time extension or compensation will be provided for delays caused by or within the control

of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

- D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

- A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:
1. Contract;
 2. Performance/payment bond as described in Article 6.1;
 3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
 4. Written Affirmative Action Plans as required in Article 1.4.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working

days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

- C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

- A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.
- B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working

days notice before the inspection shall be performed.

2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.
 3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders

and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

- D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.
- E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will

be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
 2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project
- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
- C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
- D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
 2. Delivery is made in accordance with the time frame on the approved schedule.
 3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.

4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
- E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:
1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 2. Materials stored in one location off site are valued in excess of \$25,000.
 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or

items. The cost of corrective action(s) shall be borne by the Contractor.

2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from

the Surety to final payment accepting liability for any unpaid amounts.

- b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
 - c) Certified copies of all payrolls
 - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
 4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
 5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

- A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.
- B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.

B. Minimum Scope and Extent of Coverage

1. General Liability

Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.

2. Automobile Liability

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".

3. Workers' Compensation and Employer's Liability

Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.

4. Builder's Risk or Installation Floater Insurance

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contract price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

1. General Liability

Contractor

\$2,000,000	combined single limit per occurrence for bodily injury, personal injury, and property damage
-------------	--

\$2,000,000	annual aggregate
-------------	------------------

2. Automobile Liability

\$2,000,000	combined single limit per occurrence for bodily injury and property damage
-------------	--

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of \$1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing

payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance

programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract -

the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.
2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive

calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

- B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
- C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
- D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
- E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
- F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

- A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing

and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.
2. Take actions to protect the work and any stored materials.
3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
4. Terminate all existing subcontracts, rentals, material, and equipment orders.

5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.

6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer: John Neyens
Klingner & Associates, P.C.
907 East Ash
Columbia, MO 65201
Telephone: (573) 355-5988
Email: jjn@klingner.com

MONG Project Manager /
Construction Representative: Joseph Schaefer
Missouri National Guard-CFMO Office
6819a North Boundary Road
Jefferson City, Missouri 65101
Telephone: (573) 690-4945
Email: joseph.e.schaefer10.nfg@army.mil

Project Manager: Jared Cook
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 690-6733
Email: jared.cook2@oa.mo.gov

Contract Specialist: Paul Girouard
Division of Facilities Management, Design and
Construction 301 West High Street, Room 730
Jefferson City, Missouri 65102
Telephone: (573) 751-4797
Email: Paul.Girouard@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

- A. The Owner will furnish the Contractor with approximately 5 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 5 sets of explanatory or change drawings at no charge.
- C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

6.0 ENVIRONMENTAL MANAGEMENT SYSTEM (eMS):

The Missouri Army National Guard (MOARNG) has implemented an Environmental Management System (eMS). One of the key components of the eMS is the establishment of an Environmental Policy that must be communicated to all persons working for or on behalf of the organization including all suppliers and contractors. This policy stresses commitment to compliance with accepted environmental practices, and meeting or exceeding applicable environmental requirements, legal and otherwise. This policy also stresses commitment to waste minimization, pollution prevention, and management of personnel, processes, real property, and materials in a manner to reduce environmental impacts. The policy is available upon request to all parties by contacting the Environmental Management Office at (573) 638-9514.

7.0 OFF-SITE BORROW & SPOIL DEPOSIT SITES FOR FEDERALLY FUNDED PROJECTS:

All Federally funded projects which involve off-site borrow and/or off-site spoil deposit sites will require written certification that the site(s) are in compliance with the National Environmental Protection Act and all related applicable Federal and State laws and regulations. If the need for off-site borrow and/or spoil sites is stipulated in the Contract Documents, the following applies:

- A. The Contractor is required to use only the designated site described in the Contract Documents. If another off-site area is proposed by the Contractor, the Contractor must provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.
- B. If project conditions require off-site borrow or off-site deposit of spoils, the Contractor will be required to provide written certification to the Division of Facilities Management, Design and Construction Project Representative that the proposed borrow or spoil site has been cleared of environmental concerns in accordance with all applicable Federal and State laws and regulations. These include but are not limited to the following: Clean Water Act; the Endangered Species Act; the National Historic Preservation Act (NHPA) (The site must have Section 106 Clearance); the Farmland Protection Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response; Compensation and Liability Act; and RSMo Chapter 194, Section 194.400, Unmarked Human Burial Sites. Certifications shall include clearance letters and other evidence of coordination with the appropriate regulatory agencies. The Missouri Historic Preservation Office, PO Box 176 Jefferson City, MO 65102, may be contacted to provide assistance with the NHPA and cultural resource issues pertaining to the borrow and spoil site regulations. The Missouri State Historic Preservation Office can provide a list of qualified and certified archaeologists to assist in borrow and spoil site investigations.
- C. The Owner recognizes that additional time (beyond what is allowed in the Construction Contract) may be required in order to secure the aforementioned certifications and approvals. Should more time be required, the Owner will consider approval of a no-cost time extension contract change. The Contractor will be required to provide documentation that substantiates the need for the time extension.

SECTION 007333 - SUPPLEMENTARY GENERAL CONDITIONS FOR FEDERALLY FUNDED/ASSISTED CONSTRUCTION PROJECTS

1.0 Notice of Federal Funding

This project is being performed in whole or in part using federal funds. Therefore, all work or services performed by the Contractor and its subcontractors shall be subject to the terms and conditions set forth below in addition to all terms and conditions in the Construction Contract, General Conditions, and other contract documents. The concepts, rules, and guidelines set forth in 2 C.F.R. 200 describing allowable costs and administrative requirements apply.

2.0 Definitions

As used herein, "Federal Government" means the government of the United States of America. "Federal Agency" means an agency, entity, department or division of the Federal Government that is providing funding for this project. All other terms shall have the meanings established in the Construction Contract, General Conditions, and/or Project Manual, unless such definitions conflict with a definition provided in an applicable statute or regulation.

3.0 Conflicting Terms or Conditions

To the extent that any terms or conditions set forth herein conflict with the Construction Contract or its General Conditions, the more stringent of the two terms and conditions shall govern.

4.0 No Obligation by Federal Government

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, Contractor, or any other party pertaining to any matter resulting from the contract.

5.0 Compliance with Federal Laws, Regulations and Executive Orders

The Contractor and its subcontractors and suppliers are required to comply with all applicable Federal laws, regulations, and executive orders, regardless of whether set forth herein. The Contractor shall assist and enable the State of Missouri in complying with any requirements imposed by the Federal Agency as a condition of funding.

6.0 Compliance with Civil Rights Provisions

The Contractor shall comply with all Federal statutes, executive orders, and regulations relating to nondiscrimination. These include, but are not limited to the following:

Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin;

Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex;

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps;

The Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age;

Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing;

Title VII of the Civil Rights Act of 1964 (42 U.S.C. part 2000(e), which prohibits discrimination against employees on the basis of religion;

Any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and

The requirements of any other nondiscrimination statute(s) that may apply to the application.

7.0 Equal Employment Opportunity (41 C.F.R. 60-1.4(b)).

During the performance of this contract, the Contractor agrees as follows:

- (1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

- (2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- (3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicants or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.
- (4) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- (5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

- (6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- (7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (8) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: *Provided*, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and sub contractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and sub contractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

8.0 Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity
(Executive Order 11246, 41 C.F.R. 60-4.2)

(1) The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

(2) The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Time- tables	Goals for minority participation for each trade	Goals for female participation in each trade
107	12.7%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 C.F.R. pt. 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 C.F.R. 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 C.F.R. pt. 60-4. Compliance with the goals will be measured against the total work hours performed.

(3) The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(4) As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

9.0 Standard Federal Equal Employment Opportunity Construction Contract Specifications
(Executive Order 11246 - 41 C.F.R. 60-4.3)

(1) As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

(3) If the Contractor is participating (pursuant to 41 C.F.R. 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

(4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

(5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

(6) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all

minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 C.F.R. pt. 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

(8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint

contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

(10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

(11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

(12) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

(13) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 C.F.R. 60-4.8.

(14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

(15) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of

local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

10.0 Prohibition of Segregated Facilities

- (1) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.
- (2) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.
- (3) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

11.0 Davis-Bacon Act (40 U.S.C. §§ 3141-3144, and §§ 3146-3148, and 29 C.F.R. pt. 5)

- (1) Minimum wages.
 - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 C.F.R. pt. 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- (ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- (iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.
- (2) Withholding. The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage

requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

- (i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis–Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis–Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.
- (ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime Contractor to require a subcontractor to provide addresses and social security numbers to the prime Contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

- (B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
- (1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 C.F.R. pt. 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 C.F.R. pt. 5, and that such information is correct and complete;
 - (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 C.F.R. pt. 3;
 - (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
- (C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.
- (D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.
- (iii) The Contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal Agency may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. 5.12.
- (4) Apprentices and trainees—
- (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any

apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) Trainees. Except as provided in 29 C.F.R. 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 C.F.R. pt. 30.
- (5) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 C.F.R. pt. 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 C.F.R. 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal Agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. 5.5.

- (7) Contract termination: debarment. A breach of the contract clauses in 29 C.F.R. 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. 5.12.
- (8) Compliance with Davis–Bacon and Related Act requirements. All rulings and interpretations of the Davis–Bacon and Related Acts contained in 29 C.F.R. pts. 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. pts. 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
- (10) Certification of eligibility.
 - (i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis–Bacon Act or 29 C.F.R. 5.12(a)(1).
 - (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

11.0 Copeland “Anti-Kickback” Act

- (1) The Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract. The Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled.
- (2) The Contractor or subcontractor shall insert in any subcontracts the clause above, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 C.F.R. 5.12.

12.0 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 to 3708, 29 C.F.R. 5.5)

- (1) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

13.0 Suspension and Debarment (Executive Orders 12549 and 12689, 2 C.F.R. pt. 180)

- (1) A contract award (see 2 C.F.R. 180.220) must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (3 C.F.R. pt. 1986 Comp., p. 189) and 12689 (3 C.F.R. pt. 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- (2) The contractor is required to verify that none of the contractor’s principals (defined at 2 C.F.R. 180.995) or its affiliates (defined at 2 C.F.R. 180.905) are excluded (defined at 2 C.F.R. 180.940) or disqualified (defined at 2 C.F.R. 180.935).
- (3) The contractor must comply with 2 C.F.R. pt. 180, subpart C and the regulations of the granting Federal Agency regarding suspension and debarment, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- (4) This certification is a material representation of fact relied upon by the Owner. If it is later determined that the Contractor did not comply with 2 C.F.R. pt. 180, subpart C in addition to remedies available to the Owner, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- (5) By submitting a bid, the bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C while this offer is valid and throughout the period of any contract that may arise from this

offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

14.0 Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352)

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

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form–LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

15.0 Procurement of Recovered Materials

The Contractor shall comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. § 6962). The requirements of Section 6002 include

procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Information about this requirement, along with the list of EPA designated items, is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

16.0 Fair Labor Standards Act

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 C.F.R. pt. 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers. The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

17.0 Access to Records and Reports

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Agency and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

18.0 Occupational Health and Safety Act

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 C.F.R. pt. 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 C.F.R. pt. 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

19.0 Rights to Inventions

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 C.F.R. pt. 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 C.F.R. 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

20.0 Energy Conservation

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201 et seq.).

21.0 Clean Air Act and Federal Water Pollution Control Act

- (1) If the amount of the Contract exceeds \$150,000, the Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq. and the Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq.
- (2) The Contractor agrees to report each violation to the Owner, and understands and agrees that the Owner will, in turn, report each violation as required to assure notification to the Federal Agency and the appropriate Environmental Protection Agency Regional Office.
- (3) The Contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance.

22.0 Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights

- (1) This contract and employees working on this contract will be subject to the whistleblower rights and remedies in the pilot program on contractor employee whistleblower protections established at 41 U.S.C. § 4712 by section 828 of the National Defense Authorization Act for Fiscal Year 2013 (Pub. L. 112-239) and FAR 3.908.
- (2) The Contractor shall inform its employees in writing, in the predominant language of the workforce, of employee whistleblower rights and protections under 41 U.S.C. § 4712, as described in section 3.908 of the Federal Acquisition Regulation.
- (3) The Contractor shall insert the substance of this clause, including this paragraph (c), in all subcontracts over the simplified acquisition threshold.

23.0 Veteran's Preference

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

24.0 Drug Free Workplace Act

The Contractor shall provide a drug free workplace in accordance with the Drug Free Workplace Act of 1988, 41 U.S.C. Chapter 81, and all applicable regulations. The Contractor shall report any conviction of the Contractor's personnel under a criminal drug statute for violations occurring on the Contractor's premises or off the Contractor's premises while conducting official business. A report of a conviction shall be made to the state agency within five (5) working days after the conviction.

25.0 Access Requirements for Persons with Disabilities

Contractor shall comply with 49 U.S.C. § 5301(d), stating Federal policy that the elderly and persons with disabilities have the same rights as other persons to use mass transportation services and facilities and that special efforts shall be made in planning and designing those services and facilities to implement that policy. Contractor shall also comply with all applicable requirements of Sec. 504 of the Rehabilitation Act (1973), as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, and the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. § 12101 et seq., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments thereto.

26.0 Seismic Safety

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Guidelines for Contract Provisions for Obligated Sponsors and Airport Improvement Program Projects Issued on June 19, 2018 Page 61 Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

27.0 Domestic Preference for Procurements

As appropriate and to the extent consistent with law, the Contractor should, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this contract. For purposes of this section:

- (1) “Produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- (2) “Manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

28.0 Prohibition on Certain Telecommunication and Video Surveillances Services or Equipment (Pub. L. 115-232, Section 889)

Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of a Federal executive agency and recipients or subrecipients of funds from such agencies from obligating or expending grant, cooperative agreement, loan, or loan guarantee funds on certain telecommunications products or from certain entities for national security reasons. Pursuant to such provisions, the Contractor understands and agrees that the Contractor and its subcontractors shall not obligate or expend loan or grant funds from the Federal Agency under this Contract to:

- (1) Procure or obtain;
- (2) Extend or renew a contract to procure or obtain; or
- (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any

system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 29

Section 026
COLE COUNTY

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

Original Signed by

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: March 10, 2022

Last Date Objections May Be Filed: April 11, 2022

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$53.18
Boilermaker	\$27.22*
Bricklayer	\$51.39
Carpenter	\$47.88
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$41.24
Plasterer	
Communications Technician	\$55.00
Electrician (Inside Wireman)	\$55.64
Electrician Outside Lineman	\$74.20
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$27.22*
Glazier	\$56.16
Ironworker	\$61.89
Laborer	\$41.21
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$27.22*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$60.02
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$39.08
Plumber	\$66.28
Pipe Fitter	
Roofer	\$51.92
Sheet Metal Worker	\$54.06
Sprinkler Fitter	\$62.10
Truck Driver	\$41.74
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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

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

Heavy Construction Rates for
COLE County

Section 026

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$53.63
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$74.20
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$43.21
General Laborer	
Skilled Laborer	
Operating Engineer	\$58.94
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$45.80
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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

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

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

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

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

OVERTIME and HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

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

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

"General Decision Number: MO20220040 08/05/2022

Superseded General Decision Number: MO20210040

State: Missouri

Construction Type: Building

County: Cole County in Missouri.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Modification Number	Publication Date
0	01/07/2022
1	02/18/2022

2	02/25/2022
3	04/01/2022
4	04/22/2022
5	05/27/2022
6	07/29/2022
7	08/05/2022

ASBE0001-005 10/02/2020

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 40.44	25.14

BOIL0027-001 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 38.37	33.66

BRM00011-002 03/01/2020

	Rates	Fringes
BRICKLAYER.....	\$ 30.75	18.73
TILE SETTER.....	\$ 30.75	18.73

CARP0010-010 05/01/2022

	Rates	Fringes
CARPENTER (Including Form Work).....	\$ 27.91	19.70

ELEC0257-001 03/01/2021

	Rates	Fringes
ELECTRICIAN.....	\$ 34.60	16.38

ELEV0003-001 01/01/2022

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 55.29	36.885+a+b

a. VACATION: Employer contributes 8% of basic hourly rate as vacation pay credit for more than 5 years of service; and 6% for 6 months to 5 years of service.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day and Christmas Day.

ENGI0513-002 05/01/2022

	Rates	Fringes
Power equipment operators:		
Backhoe/Excavator.....	\$ 33.51	28.82
Bobcat/Skid Loader.....	\$ 33.51	28.82
Crane.....	\$ 33.51	28.82
Forklift.....	\$ 33.51	28.82
Grader/Blade.....	\$ 33.51	28.82

Loader.....	\$ 33.51	28.82
Paver.....	\$ 33.51	28.82
Roller.....	\$ 33.51	28.82

IRON0396-003 08/04/2021

	Rates	Fringes
--	-------	---------

IRONWORKER, ORNAMENTAL, REINFORCING AND STRUCTURAL.....	\$ 32.24	28.96
--	----------	-------

LAB00955-007 03/01/2022

	Rates	Fringes
--	-------	---------

LABORER

Brick & Cement/Concrete Mason Tender.....	\$ 28.12	15.39
Common or General; Asphalt Shoveler; Pipelayer.....	\$ 26.12	15.39

PAIN0002-005 04/01/2020

	Rates	Fringes
--	-------	---------

PAINTER: Brush and Roller.....	\$ 24.64	13.98
--------------------------------	----------	-------

PLAS0518-014 03/01/2022

	Rates	Fringes
--	-------	---------

CEMENT MASON/CONCRETE FINISHER...	\$ 29.72	14.98
-----------------------------------	----------	-------

* PLUM0562-002 07/01/2022

	Rates	Fringes
--	-------	---------

PIPEFITTER, Includes HVAC

Pipe Installation

Mechanical Contracts including all piping and temperature control work \$7.0 million & under.....	\$ 44.66	21.49
Mechanical Contracts including all piping and temperature control work over \$7.0 million.....	\$ 44.66	21.49

PLUMBER, Excludes HVAC Pipe

Installation

Mechanical Contracts including all piping and temperature control work \$7.0 million & under.....	\$ 44.66	21.49
Mechanical Contracts including all piping and temperature control work over \$7.0 million.....	\$ 44.66	21.49

ROOF0020-012 09/19/2020

	Rates	Fringes
--	-------	---------

ROOFER.....	\$ 31.30	17.59
-------------	----------	-------

SHEE0036-002 07/01/2018

	Rates	Fringes
SHEET METAL WORKER, Includes HVAC Duct and Unit Installation.....	\$ 50.67	18.36

* SUM02010-039 06/14/2010		

	Rates	Fringes
GLAZIER.....	\$ 14.84 **	1.02
OPERATOR: Hoist.....	\$ 26.02	13.01
PAINTER: Spray.....	\$ 17.78	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

=====

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$15.00) or 13658 (\$11.25). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISIO"

SECTION 011000 – SUMMARY OF WORK

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 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of the construction of a building addition on the east end of Building 1270.
 - 1. Project Location: 7001 Range Road, Ike Skelton Training Site, Jefferson City, Missouri.
 - 2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.
- B. Contract Documents, dated July 29, 2022 were prepared for the Project by Klingner & Associates, P.C, 907 East Ash, Columbia, Missouri.
- C. The Work consists of construction a new fitness center at the Ike Skelton Training Site. Major products and systems include site preparation, site utilities, concrete, pre-engineered steel building structure, masonry, plumbing, heating/ventilating/cooling system, and electrical systems.
- D. The Work will be constructed under a single prime contract.

1.3 WORK SEQUENCE

- A. The Work will be conducted in one phase.

1.4 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.5 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: The Owner will occupy the site during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011000

SECTION 012100 – 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.
- B. Types of allowances include the following:
 - 1. Weather 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.

1.3 WEATHER ALLOWANCE

- A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).
- B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities”. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.
- C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.
- D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.
- E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

- A. Weather Allowance: Included within the completion period for this Project (10) ten “bad weather” days.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

- A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.
- B. No additional time will be allowed for alternate work unless the number of work days is so stated on the bid form.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.
- C. Execute accepted alternates under the same conditions as other Work of this Contract.
- D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: *Provide exterior brick wainscoat around building perimeter as shown within the Drawings and Project Manual..*

- B. Alternate No. 2: *Provide athletic flooring in various areas of the building as shown within the Drawings and Project Manual.*
- C. Alternate No. 3: *Provide epoxy flooring in various areas of the building as shown within the Drawings and Project Manual.*
- D. Alternate No. 4: *Provide parking lot fill and pavement in various areas of the site as shown within the Drawings and Project Manual.*

END OF SECTION 012300

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

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 specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
 - 1. Division 1, Section 012100 "Allowances" for procedural requirements for handling and processing Allowances.
 - 2. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
 - 3. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 4. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

- A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a "Request for Information" (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.
- C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

- A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

1.5 PROPOSAL REQUESTS

- A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
 - a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
 - b. If requesting additional time per Article 4.2 of the General Conditions, 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.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 – COORDINATION

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 provisions for coordinating construction operations on Projects including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.
- C. Related Sections include the following:
 - 1. Division 1, Section 013200 "Schedules" for preparing and submitting Contractor's Construction Schedule.
 - 2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
 - 3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

- 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, which depend on each other for proper installation, connection, and operation.
- B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with 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 with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required

maintenance, service, and repair of all components including mechanical and electrical.

- C. 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.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Startup and adjustment of systems.
 - 8. Project Closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

- A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The

Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.
- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".
1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation 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 Designer and Construction Representative 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
 - j. Compatibility problems
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written recommendations
 - 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. Contractor shall 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 parties who should have been present.
 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.
 6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
 7. Project name
 8. Name and address of Contractor
 9. Name and address of Designer
 10. RFI number including RFIs that were dropped and not submitted
 11. RFI description
 12. Date the RFI was submitted
 13. Date Designer's response was received
 14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013115 - PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013300 - Submittals
- C. Division 1, Section 012600 – Contract Modification Procedures

1.2 SUMMARY

- A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
 - 1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
 - 2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited
- B. Support: E-Builder® will provide on-going support through on-line help files.
- C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files
- E. Authorized Users: Access to the web site will be by individuals who are authorized users.
 - 1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: <https://oa.mo.gov/facilities/vendor-links/contractor-forms>. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
 - 2. Authorized users will be contacted directly and assigned a temporary user password.
 - 3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
- F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:

1. Document Integrity and Revisions:
 - a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
 - b. The system shall make it easy to identify revised or superseded documents and their predecessors.
 - c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
2. Document Security:
 - a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. **DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!**
3. Document Integration:
 - a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
4. Reporting:
 - a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
5. Notifications and Distribution:
 - a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
6. Required Document Types:
 - a. RFI, Request for Information.
 - b. Submittals, including record numbering by drawing and specification section.
 - c. Transmittals, including record of documents and materials delivered in hard copy.
 - d. Meeting Minutes.
 - e. Application for Payments (Draft or Pencil).
 - f. Review Comments.
 - g. Field Reports.
 - h. Construction Photographs.
 - i. Drawings.
 - j. Supplemental Sketches.
 - k. Schedules.
 - l. Specifications.
 - m. Request for Proposals
 - n. Designer's Supplemental Instructions
 - o. Punch Lists

H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.

- a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
 - b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
 - c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.
- I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
1. Providing suitable computer systems for each licensed user at the users normal work location¹ with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 2. Each of the above referenced computer systems shall have the following minimum system² and software requirements:
 - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
 - 1) Operating System: Windows XP or newer
 - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
 - 3) Minimum Recommend Connection Speed: 256K or above
 - 4) Processor Speed: 1 Gigahertz and above
 - 5) RAM: 512 mb
 - 6) Operating system and software shall be properly licensed.
 - 7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - 8) Adobe Acrobat Reader (current version is a free distribution for download).
 - 9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

¹ The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

² The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013200 – SCHEDULES – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

- A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.
 - 1. The Schedule of Values must have the following line items included with the value of the item as indicated below:
 - a. O&M's (Owner's Manual)
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - b. Close Out Documents
 - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
 - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - c. General Conditions
 - 1) No more than 10%
- B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

- C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 – Allowances.
 - 1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
 - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
 - 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
 - 3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 - 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
 - 6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
 - 1. Requirement for Phased completion
 - 2. Work by separate Contractors
 - 3. Work by the Owner
 - 4. Pre-purchased materials
 - 5. Coordination with existing construction
 - 6. Limitations of continued occupancies

7. Un-interruptible services
 8. Partial Occupancy prior to Substantial Completion
 9. Site restrictions
 10. Provisions for future construction
 11. Seasonal variations
 12. Environmental control
- C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:
1. Subcontract awards
 2. Submittals
 3. Purchases
 4. Mockups
 5. Fabrication
 6. Sample testing
 7. Deliveries
 8. Installation
 9. Testing
 10. Adjusting
 11. Curing
 12. Startup and placement into final use and operation
- D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a “major area” is a story of construction, a separate building, or a similar significant construction element.
1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure
 - c. Completion of mechanical installation
 - d. Completion of the electrical portion of the Work
 - e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

- A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.
- B. Prepare the schedule in chronological order. Provide the following information

1. Scheduled date for the first submittal
 2. Related Section number
 3. Submittal category
 4. Name of the Subcontractor
 5. Description of the part of the Work covered
 6. Scheduled date for resubmittal
 7. Scheduled date for the Designer's final release or approval
- C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.
1. Post copies in the Project meeting room and temporary field office.
 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.
- D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

- A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.
- B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:
1. Specification Section number
 2. Description of the test
 3. Identification of applicable standards
 4. Identification of test methods
 5. Number of tests required
 6. Time schedule or time span for tests
 7. Entity responsible for performing tests
 8. Requirements for taking samples
 9. Unique characteristics of each service
- C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 013200

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Samples
 - 4. Quality Assurance Submittals
 - 5. Construction Photographs
 - 6. Operating and Maintenance Manuals
 - 7. Warranties
- B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Construction Progress Schedule including Schedule of Values
 - 2. Performance and Payment Bonds
 - 3. Insurance Certificates
 - 4. Applications for Payment
 - 5. Certified Payroll Reports
 - 6. Partial and Final Receipt of Payment and Release Forms
 - 7. Affidavit – Compliance with Prevailing Wage Law
 - 8. Record Drawings
 - 9. Notifications, Permits, etc.
- C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.
- D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

- A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 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 elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:
 - 1. Date of Submission
 - 2. Name of Project
 - 3. Location
 - 4. Section Number of Specification
 - 5. State Project Number
 - 6. Name of Submitting Contractor
 - 7. Name of Subcontractor
 - 8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

- A. Comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:
 - 1. Dimensions
 - 2. Identification of products and materials included by sheet and detail number
 - 3. Compliance with specified standards
 - 4. Notation of coordination requirements

5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

1.5 PRODUCT DATA

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with Trade Association standards
 - c. Compliance with recognized Testing Agency standards
 - d. Application of Testing Agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:
 - a. Specification Section number and reference
 - b. Generic description of the Sample
 - c. Sample source
 - d. Product name or name of the Manufacturer
 - e. Compliance with recognized standards
 - f. Availability and delivery time
 2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

- a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
3. Field samples are full-size examples erected onsite to illustrate finishes, coatings, or finish materials and to establish the Project standard.
- a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.7 QUALITY ASSURANCE DOCUMENTS

- A. The Contractor shall comply with the General Conditions, Article 3.2
- B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.
- D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.
- E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.
 - 1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
 - 2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.
 - 3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.
 - 4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

- A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

- A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

SPEC SECTION	TITLE	CATEGORY
013100	Coordination	Certification
013100	Coordination	Shop Drawings
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013513	Site Security and Health Requirements	Product Data
013513	Site Security and Health Requirements	Certification
013513	Site Security and Health Requirements	Construction Schedule
031000	Concrete Forming And Accessories	Shop Drawings
032000	Concrete Reinforcing	Shop Drawings
032000	Concrete Reinforcing	Product Data
032000	Concrete Reinforcing	Certification
033000	Cast-In-Place Concrete	Certification
033000	Cast-In-Place Concrete	Product Data
033000	Cast-In-Place Concrete	Operation / Maintenance Manual
033543	Special Concrete Floor Finishes	Product Data
033543	Special Concrete Floor Finishes	Test Report
033543	Special Concrete Floor Finishes	Certification

SPEC SECTION	TITLE	CATEGORY
033543	Special Concrete Floor Finishes	Warranty
033543	Special Concrete Floor Finishes	Mock up
042000	Unit Masonry	Product Data
042000	Unit Masonry	Shop Drawings
042000	Unit Masonry	Sample
042000	Unit Masonry	Certification
061000	Rough Carpentry	Product Data
066140	Solid Surfacing	Shop Drawings
066140	Solid Surfacing	Sample
066140	Solid Surfacing	Certification
081100	Metal Door Frames	Product Data
081100	Metal Door Frames	Shop Drawings
081300	Metal Doors	Product Data
081300	Metal Doors	Shop Drawings
084113	Aluminum-Framed Entrances And Storefronts	Product Data
084113	Aluminum-Framed Entrances And Storefronts	Shop Drawings
084113	Aluminum-Framed Entrances And Storefronts	Sample
084113	Aluminum-Framed Entrances And Storefronts	Operation / Maintenance Manual
084113	Aluminum-Framed Entrances And Storefronts	Warranty
087100	Door Hardware	Product Data
087100	Door Hardware	Certification
087100	Door Hardware	Warranty
087100	Door Hardware	Operation / Maintenance Manual
088000	Glazing	Product Data
088000	Glazing	Sample
088000	Glazing	Test Report

SPEC SECTION	TITLE	CATEGORY
092216	Non-Structural Metal Framing	Product Data
092900	Gypsum Board	Product Data
092900	Gypsum Board	Sample
095113	Acoustical Panel Ceilings	Product Data
096450	Resilient Athletic Flooring	Product Data
096450	Resilient Athletic Flooring	Sample
096450	Resilient Athletic Flooring	Warranty
096519	Resilient Flooring	Shop Drawings
096519	Resilient Flooring	Product Data
096519	Resilient Flooring	Sample
096723	Resinous Flooring	Product Data
096723	Resinous Flooring	Sample
099123	Interior Painting	Product Data
099123	Interior Painting	Sample
102113	Solid Plastic Toilet Compartments	Product Data
102113	Solid Plastic Toilet Compartments	Shop Drawings
102113	Solid Plastic Toilet Compartments	Sample
102113	Solid Plastic Toilet Compartments	Warranty
102113	Solid Plastic Toilet Compartments	Operation / Maintenance Manual
102600	Wall Protection	Product Data
102600	Wall Protection	Shop Drawings
102600	Wall Protection	Sample
102600	Wall Protection	Operation / Maintenance Manual
102800	Toilet And Shower Accessories	Product Data
104414	Fire Extinguishers And Cabinets	Product Data
105126	Plastic Lockers And Benches	Product Data

SPEC SECTION	TITLE	CATEGORY
105126	Plastic Lockers And Benches	Operation / Maintenance Manual
105126	Plastic Lockers And Benches	Sample
105126	Plastic Lockers And Benches	Shop Drawings
105126	Plastic Lockers And Benches	Warranty
122100	Window Blinds	Product Data
122100	Window Blinds	Sample
133419	Metal Building Systems	Product Data
133419	Metal Building Systems	Shop Drawings
133419	Metal Building Systems	Sample
133419	Metal Building Systems	Certification
211000	Water-Based Fire Suppression Systems	Product Data
211000	Water-Based Fire Suppression Systems	Test Report
211000	Water-Based Fire Suppression Systems	As-Builts
211000	Water-Based Fire Suppression Systems	Operation / Maintenance Manual
220500	Common Work Results For Plumbing	Shop Drawings
220500	Common Work Results For Plumbing	Certification
220519	Meters And Gages For Plumbing Piping	Product Data
220523	General Duty Valves For Plumbing Piping	Product Data
220529	Hangers And Supports For Plumbing Piping And Equipment	Product Data
220553	Identification For Plumbing Piping And Equipment	Product Data
220700	Plumbing Insulation	Product Data
221116	Domestic Water Piping	Product Data
221316	Sanitary Waste And Vent Piping	Test Report
221119	Domestic Water Piping Specialties	Product Data
221119	Domestic Water Piping Specialties	Test Report

SPEC SECTION	TITLE	CATEGORY
221119	Domestic Water Piping Specialties	Operation / Maintenance Manual
221319	Sanitary Waste Piping Specialties	Product Data
223400	Fuel Fired Domestic Water Heaters	Product Data
223400	Fuel Fired Domestic Water Heaters	Shop Drawings
223400	Fuel Fired Domestic Water Heaters	Operation / Maintenance Manual
223400	Fuel Fired Domestic Water Heaters	Warranty
224000	Plumbing Fixtures	Product Data
224700	Drinking Fountains And Water Coolers	Product Data
224700	Drinking Fountains And Water Coolers	Operation / Maintenance Manual
225000	Facility Natural Gas Piping	Product Data
230500	Common Work Results For Hvac	Product Data
230553	Identification For Hvac Piping And Equipment	Product Data
230593	Testing, Adjusting, And Balancing For Hvac	Test Report
230700	Hvac Insulation	Product Data
230900	Instrumentation And Control For Hvac	Product Data
230900	Instrumentation And Control For Hvac	Shop Drawings
230900	Instrumentation And Control For Hvac	Test Report
230900	Instrumentation And Control For Hvac	Operation / Maintenance Manual
232301	Vrv/Vrf Refrigerant Piping	Product Data
232301	Vrv/Vrf Refrigerant Piping	Shop Drawings
233113	Metal Ducts	Product Data
233713	Diffusers, Registers, And Grilles	Product Data
237200	Air-To-Air Energy Recovery Equipment	Product Data
237200	Air-To-Air Energy Recovery Equipment	Operation / Maintenance Manual
238200	Variable Refrigerant Flow Hvac Systems	Product Data
238200	Variable Refrigerant Flow Hvac Systems	Operation / Maintenance Manual

SPEC SECTION	TITLE	CATEGORY
238200	Variable Refrigerant Flow Hvac Systems	Warranty
238216	Air Coils	Product Data
239100	Louvers	Product Data
239100	Louvers	Shop Drawings
260519	Low Voltage Electrical Power Conductors And Cables	Product Data
260533	Raceway And Boxes For Electrical Systems	Product Data
260923	Lighting Control Devices	Product Data
260923	Lighting Control Devices	Shop Drawings
260923	Lighting Control Devices	Operation / Maintenance Manual
262416	Panelboards	Product Data
262416	Panelboards	Shop Drawings
262726	Wiring Devices	Product Data
262816	Enclosed Switches And Circuit Breakers	Product Data
265100	Interior Lighting	Product Data
271500	Communications Horizontal Cabling	Product Data
271500	Communications Horizontal Cabling	Test Report
283111	Digital, Addressable Fire-Alarm System	Product Data
283111	Digital, Addressable Fire-Alarm System	Shop Drawings
283111	Digital, Addressable Fire-Alarm System	Test Report
283111	Digital, Addressable Fire-Alarm System	Operation / Maintenance Manual
310516	Aggregates For Earthwork	Product Data
310516	Aggregates For Earthwork	Test Report
310516	Aggregates For Earthwork	Sample
312300	Excavation And Fill	Product Data
312300	Excavation And Fill	Sample

SPEC SECTION	TITLE	CATEGORY
321313	Concrete Paving	Product Data
321313	Pavement Striping	Product Data
329219	Seeding	Certification
329219	Seeding	Construction Schedule
329219	Seeding	Operation / Maintenance Manual
329300	Landscaping	Product Data
329300	Landscaping	Sample
329300	Landscaping	Certification
329300	Landscaping	Operation / Maintenance Manual
331110	Site Water Distribution	Product Data
331110	Site Water Distribution	Certification
334100	Storm Utility Drainage Piping	Product Data
334100	Storm Utility Drainage Piping	Shop Drawings
334101	Sanitary Sewerage System	Product Data
334101	Sanitary Sewerage System	Shop Drawings

END OF SECTION 013300

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013513.28 – SITE SECURITY AND HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

- A. List of required submittals:
 - 1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
 - 2. Schedule of proposed shutdowns, if applicable.
 - 3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

- A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.
- B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.
- C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.
- D. All construction personnel shall visibly display issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

- A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.
 - 1. Onsite burning is prohibited.
 - 2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
 - 3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of

flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.

- B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.
- C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.
- D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.
- E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.
- F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.
- G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.
- H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

A. FMDC REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK

- 1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.
- 2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to FMDCSecurity@oa.mo.gov a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The

Contractor and its employees must comply with the process for background checks and <https://oa.mo.gov/fmdc-contractor-id-badges>.

3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.
4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.
6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.
7. The Contractor shall notify FMDC via email to FMDCSecurity@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.
8. Upon award of a Contract, the Contractor should contact FMDC at FMDCSecurity@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

3.4 DISRUPTION OF UTILITIES

- A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.
- B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

END OF SECTION 013513.28

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Temporary electric power and light
 - 3. Temporary heat
 - 4. Ventilation
 - 5. Telephone service
 - 6. Sanitary facilities, including drinking water
 - 7. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds
 - 2. Temporary roads and paving
 - 3. Dewatering facilities and drains
 - 4. Temporary enclosures
 - 5. Hoists and temporary elevator use
 - 6. Temporary project identification signs and bulletin boards
 - 7. Waste disposal services
 - 8. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection
 - 2. Barricades, warning signs, and lights
 - 3. Sidewalk bridge or enclosure fence for the site
 - 4. Environmental protection

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements

2. Health and safety regulations
 3. Utility company regulations
 4. Police, fire department, and rescue squad rules
 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”. ANSI A10 Series standards for “Safety Requirements for Construction and Demolition”, and NECA Electrical Design Library “Temporary Electrical Facilities”.
1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.
1. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
 2. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8” (16mm) thick exterior plywood.
- C. Water: Provide potable water approved by local health authorities.
- D. Open-Mesh Fencing: Provide 0.120” (3mm) thick, galvanized 2” (50mm) chainlink fabric fencing 6’ (2m) high with galvanized steel pipe posts, 1½” (38mm) ID for line posts and 2½” (64mm) ID for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

- B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. 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: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 1. Install electric power service underground, except where overhead service must be used.
 - 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
 2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- F. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.
- G. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Shield toilets to ensure privacy.
 2. Provide separate facilities for male and female personnel.
 3. Provide toilet tissue materials for each facility.
- H. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
1. Provide paper towels or similar disposable materials for each facility.
 2. Provide covered waste containers for used material.
 3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- I. Drinking-Water Facilities: Provide drinking-water including paper cup supply.
- J. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.
- C. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.

1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 3. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- D. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.
- F. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.
- G. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- H. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
- I. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment

that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 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.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when 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 the 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 the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

- A. General
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least once each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
 - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

3.2 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
 1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.
 2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 3. Remove petrochemical spills, stains, and other foreign deposits.
 4. Remove tools, construction equipment, machinery, and surplus material from the site.
 5. Remove snow and ice to provide safe access to the building.
 6. 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.
 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 8. Broom clean concrete floors in unoccupied spaces.
 9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
 10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-

obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

11. Remove labels that are not permanent labels.
 12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.
 13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
 15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 16. Clean ducts, blowers, and coils if units were operated without filters during construction
 17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
 18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
 19. Leave the Project clean and ready for occupancy.
- C. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- D. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner’s property.

END OF SECTION 017400

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 024120 - SUBSURFACE CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes soils investigation at the site and use of data resulting from that investigation.

1.2 SOILS INVESTIGATION REPORT

- A. General:
 - 1. A soils investigation report has been prepared for the site by the soil investigation engineer/architect selected by the Owner.
- B. Use of Data:
 - 1. Information on the nature of the soil conditions previously encountered at the site, which may be shown on the drawings or contained in the *Soils Report*, has been provided for bidder's information and shall not be construed as a guarantee of the subsurface conditions.
 - 2. The Contractor should visit the site and shall be responsible for determining to his/her satisfaction, prior to bidding, the actual site conditions.
 - 3. A copy of the Geotechnical Investigation, *Geotechnical Investigation – ISTS New Fitness Center, Dated November 12, 2020*, performed by Geotechnics Soil & Material Testing, a Division of Klingner & Associates, P.C., is attached at the end of the specifications, solely for the Contractor's information.

1.3 QUALITY ASSURANCE

- A. Readjust work performed that does not meet technical or design requirements, but make no deviation from the Contract Documents without specific and written approval from the Owner.

1.4 UNDERGROUND UTILITIES

- A. The drawings indicate the best knowledge of the Owner and Engineer/Architect on the general location and nature of the existing and/or proposed underground utilities in the area of construction. Exploratory excavations at the site to determine insitu locations were not conducted. A utility locate was requested for this site on October 22, 2020.
- B. Quality Level "C" in accordance with CI/ASCE 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data", was utilized. Regardless of the level of investigation, the utilities shown should not be considered a warranty or guarantee of actual presence or location and the contractor remains responsible for the location, verification, and proper notification of potential utilities.
- C. Quality Levels:

- D. 1. Quality Level A provides the highest level of accuracy by locating or potholing utilities in addition to Quality Levels B, C, and D tasks. The located utility infrastructure is surveyed and mapped to develop plan and profile information.
- E. 2. Quality Level B involves designating the horizontal position of subsurface utilities through surface detection methods and recording the information through a survey method, in addition to Quality Level C and D tasks.
- F. 3. Quality Level C involves surveying visible subsurface utility structures such as manholes, hand-holes, utility valves and meters, fire hydrants, pedestals, and utility markers, and then correlating the information with existing utility records to create composite drawings, in addition to Quality Level D tasks.
- G. 4. Quality Level D involves collecting data from existing utility records that may include as-built drawings, distribution and service maps, existing geographic information system databases, construction plans, etc.
- H. The Contractor shall be responsible for locating all utilities on site prior to the start of construction. The Contractor shall contact Missouri One Call at 1-800-344-7483, 48 hours before scheduled work.
- I. Damages to utilities caused by the Contractor's failure to properly investigate existence in the area shall be the sole responsibility of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 024120

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Form accessories.
 - 4. Form stripping.
- B. Related Divisions are 02 through 33.

1.3 SYSTEM DESCRIPTION

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and International Building Code requirements.

1.4 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. ACI 347R - Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. American Society of Mechanical Engineers:
 - 1. ASME A17.1 - Safety Code for Elevators and Escalators.
- E. ASTM International:

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

F. West Coast Lumber Inspection Bureau:

1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.5 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and Building Code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.6 SUBMITTALS

- A. Slab-on-Grade Joint Pattern: Submit a plan with dimensions showing floor recesses, floor drains, floor slopes, and the slab-on-grade joint pattern. Coordinate the shop drawing with information shown on the structural, architectural, mechanical, electrical, and plumbing drawings.

1.7 QUALITY ASSURANCE

- A. Design of formwork
1. Design, construction, and safety are the Contractor's responsibility.
- B. Perform Work in accordance with ACI 301, ACI 318 and ACI 347R.
- C. For wood products furnished for work of this Section, comply with AF&PA.
- D. Perform Work in accordance with State and local standards.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver void forms and installation instructions in manufacturer's packaging.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.9 COORDINATION

- A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Form Materials: At discretion of Contractor.
- B. Plywood: Douglas Fir or Spruce species; solid one side sheathing grade; sound undamaged sheets with clean, true edges.
- C. Lumber Forms:
 - 1. Application: Use for edge forms and unexposed finish concrete.
 - 2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- D. Plywood Forms:
 - 1. Application: Use for exposed finish concrete.
 - 2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
 - 3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
 - 4. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

- A. Furnish materials in accordance with State and local standards.
- B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Preformed Aluminum Forms: Minimum 12 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- D. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- E. Pan Type: Steel of size and profile required.
- F. Tubular Column Type: Round, spirally wound laminated fiber or glass fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.
- G. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4 inches thick, unless noted otherwise.
- H. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

- I. Aluminum Forms: Aluminum, suitably reinforced, and designed for particular use indicated on Drawings.
- J. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, galvanized metal, fixed length, free of defects capable of leaving holes larger than 1-1/4 inch in concrete surface.
- B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 1/2" inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers:
 - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
 - 2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
 - 3. Penetration of structural steel members is not permitted.
- D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture. Coordinate form release agent with finishes applied to the concrete.
- E. Corners: Chamfer, rigid plastic or wood strip type; 3/4"x 3/4" inch size; maximum possible lengths.
- F. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, release tape sealed slots, anchors for securing to concrete formwork.
- G. Flashing Reglets: Galvanized steel or Rigid PVC, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork.
- H. Bituminous Joint Filler: ASTM D1751.
- I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

2.4 COATINGS

- A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

- B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:

1. Trench earth forms neatly, accurately to the footing widths indicated on Drawings.
2. Trim sides and bottom of earth forms.
3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
4. Form sides of footings where earth sloughs.
5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:

1. Use steel, aluminum, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood, smooth aluminum, or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:

1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.

- 5. When placed on ground, protect against undermining, settlement or accidental impact.
- F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- H. Obtain Architect/Engineer's approval before framing openings in structural members not indicated on Drawings.
- I. Install chamfer strips on external corners of beams, joists, columns and walls.
- J. Install void forms in accordance with manufacturer's recommendations.
- K. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install water stops continuous without displacing reinforcement. Heat seal PVC or Rubber water stop joints watertight.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:

1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 ½" inches away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:

1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:

1. For concrete over waterproof membranes and vapor barrier membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347R.

3.7 ERECTION TOLERANCES

- A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Welded wire fabric.
 - 3. Reinforcement accessories.
- B. Related Divisions are 02 through 33.

1.3 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 – Specifications for Structural Concrete.
 - 2. ACI 318 - Building Code Requirements for Structural Concrete.
 - 3. ACI MNL-66 - ACI Detailing Manual.
- B. ASTM International:
 - 1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
 - 2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - 4. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 5. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - 6. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 7. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 - 8. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 9. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - 10. ASTM A1064 - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- C. American Welding Society:

1. AWS D1.4 - Structural Welding Code – Steel Reinforcing Bars.
- D. Concrete Reinforcing Steel Institute:
 1. CRSI - Manual of Standard Practice.
 2. CRSI - Placing Reinforcing Bars.
- E. The Masonry Society:
 1. TMS 402 – Building Code Requirements for Masonry Structures.
 2. TMS 602 - Specifications for Masonry Structures.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices. Provide sufficient details to permit installation of reinforcing.
- B. Product technical data including:
 1. Manufacturer installation instructions.
 2. Manufacturer and type of rebar adhesive anchors. Include code reports and installation instructions.
- C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 318.
- B. Prepare shop drawings in accordance.
- C. Perform Work in accordance with State and local standards.

1.6 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Support and store all reinforcing above ground.
- B. Ship to jobsite with attached plastic or metal tags with permanent barker numbers which match the Shop Drawing mark numbers.

1.8 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rebar adhesive anchors:
 - a. HIT-HY200 by HILTI FASTENING SYSTEMS, INC.
 - b. SET-XP by Simpson Strong-Tie
 - c. A7+ by ITW Red Head
 - d. Or as approved by engineer.

2.2 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade, deformed billet bars, uncoated finish or epoxy coated finish where indicated on plans.
- B. Deformed Reinforcement: ASTM A706; 60 ksi yield strength, steel bars, unfinished or epoxy coated finish where indicated on plans.
- C. Deformed Bar Mats: ASTM A184; fabricated from ASTM A615 or ASTM A706; 60 ksi yield strength, steel bars, unfinished.
- D. Plain Wire: ASTM A1064; unfinished or epoxy coated finish where indicated on plans.
- E. Welded Plain Wire Fabric: ASTM A1064; in flat sheets or coiled rolls; unfinished or epoxy coated finish where indicated on plans.
- F. Smooth Dowel Bars: ASTM A615, grade 60 with metal end cap to allow longitudinal movement equal to joint width plus 1 inch.

2.3 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type, epoxy coated where epoxy coated reinforcing is indicated on the plans.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions as needed including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel or Plastic tipped steel type; size and shape to meet Project conditions.
 - 1. Plastic-coated tips in contact with forms.
 - 2. Plastic coating meeting requirements of CRSI Manual of Standard Practice
- D. Reinforcing Splicing Devices:

1. Proprietary Rebar Mechanical Splices to develop in tension and compression a minimum of 125 percent of the yield strength of the reinforcing being spliced.
 2. Size to fit joined reinforcing.
- E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.4 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice and ACI 318.
- B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters in accordance with ACI 318.
- D. Fabricate column reinforcement with offset bends at reinforcement splices.
- E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous deformed bar or wire.
- F. Form ties and stirrups as indicated on the drawings in accordance with ACI 318.
- G. Weld reinforcement in accordance with AWS D1.4.
- H. Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.
- I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

2.5 SHOP FINISHING

- A. Epoxy Coated Finish for Steel Bars: ASTM A775.
- B. Epoxy Coated Finish for Steel Wire: ASTM A884; Class A using ASTM A775.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
 1. Do not weld crossing reinforcement bars for assembly.
- B. Do not displace or damage vapor retarder or barrier.
- C. Accommodate placement of formed openings.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.

1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- E. Maintain concrete cover around reinforcement as follows, unless otherwise indicated on the drawings:

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches
Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

- F. Splices: Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:
1. For reinforcing bars:
 - a. Class B splice meeting the requirements of ACI 318, Paragraph 12.15.
 2. For welded wire reinforcement:
 - a. Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than one (1) spacing of cross wires plus 2 inches, nor less than 1.5 x development length nor less than 6 inches.
 - b. Development length shall be as required for the yield strength of the welded wire reinforcement in accordance with ACI 318, Paragraph 12.8.
 3. Splice reinforcing where indicated on Drawings in accordance with splicing device manufacturer's instructions and product's code report.
 4. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer:
 - a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

G. **Welding:**

1. Obtain approval by the Engineer prior to welding reinforcing.
2. Perform welding of reinforcing bars in accordance with requirements of AWS D1.4

3.2 ERECTION TOLERANCES

- A. Install reinforcement within the tolerances specified in ACI 318 for concrete construction.

- B. Install reinforcement within the tolerances specified in TMS 602 for masonry walls.

3.3 FIELD QUALITY CONTROL

- A. The Owner shall engage a qualified testing and inspecting agency to perform field Special Inspections and testing in accordance with the applicable International Building Code and to submit reports.
- B. Provide free access to Work and cooperate with the Special Inspector. **The Contractor shall provide a minimum of 48 hours notification to the Special Inspector prior to needing an inspection.** The Contractor shall provide access to the work so the Special Inspections can be completed. The Contractor shall verify all Special Inspections have been completed and discrepancies corrected prior to closing forms or placing concrete.
- C. Reinforcement Inspection:
 - 1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
 - 2. Welding: Inspect welds in accordance with AWS D1.4.
 - 3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
 - 4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706.
 - 5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318 and International Building Code.
 - 6. Periodic Weld Inspection: Inspect reinforcement as required by ACI 318 and International Building Code.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or corrective work.

END OF SECTION 032000

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 other Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete for the following:
 - 1. Foundations
 - 2. Slabs on grade.
 - 3. Other items as indicated on drawings.
- B. Related Divisions are 02 through 33.

1.3 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305.1 – Specification for Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 308.1 - Specification for Curing Concrete.
 - 5. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 6. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 8. ASTM C150 - Standard Specification for Portland Cement.
 - 9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
 - 10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C685 - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
20. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
33. 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.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.4 SUBMITTALS

- A. Material Certificates: Submit material certificates signed by the manufacturer for the following:
 1. Admixtures
 2. Cementitious Materials
 3. Coarse Aggregate
 4. Fine Aggregate
- B. Design Data:
 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Include justification of concrete strength per ACI 301.
 - b. Hot and cold weather concrete work.

- c. Air entrained concrete work.
 - 2. Identify mix ingredients and proportions, including admixtures.
 - 3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
- C. Product Data:
- 1. Submit data on vapor barrier materials include tape and accessories.
- D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 318.
- B. Conform to ACI 305.1 when concreting during hot weather.
- C. Conform to ACI 306.1 when concreting during cold weather.
- D. Acquire cement and aggregate from one source for Work.
- E. Perform Work in accordance with State and local standards.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.
- B. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

1.8 COORDINATION

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I – Normal, Portland type
- B. Blended Cement: ASTM C595; Type IP (25% Class F), gray.

- C. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C618, Class F [Class C at interior locations only].
 - 2. Slag Cement: ASTM C989, Grades 100 or 120.
 - 3. Silica Fume: ASTM C1240.
- D. Normal Weight Aggregates: ASTM C33.
 - 1. Coarse Aggregate Maximum Size: 1-inch, in accordance with ACI 318.
 - 2. Aggregate sources shall not have a history of alkali silica reactivity.
- E. Water: ASTM C1602; potable, without deleterious amounts of chloride ions according to ACI 318.

2.2 ADMIXTURES

- A. All admixtures shall be sourced from a single manufacturer and be approved for use in the concrete mix design.
- B. Air Entrainment: ASTM C260.
- C. Chemical: ASTM C494.
 - 1. Type A - Water Reducing.
 - 2. Type C - Accelerating.
 - 3. Type D - Water Reducing and Retarding.
 - 4. Type E - Water Reducing and Accelerating.
 - 5. Type F - Water Reducing, High Range.
 - 6. Type G - Water Reducing, High Range and Retarding.
 - 7. Type S - Specific performance admixtures. Shall not affect strength development.
- D. Plasticizing: ASTM C1017
 - 1. Type I, plasticizing
 - 2. Type II, plasticizing and retarding.

2.3 ACCESSORIES

- A. Bonding Agent:
 - 1. Manufacturers:
 - a. Master Builders Solutions US LLC – Master Emaco ACH Series.
 - b. Euclid – Duralbond.
 - c. Substitutions: Permitted upon approval of Engineer
- B. Vapor Retarder: ASTM E1745 Class A 15 vapor retarder; type recommended for below grade application. Furnish joint tape recommended by manufacturer.
 - 1. Manufacturers:
 - a. Stego Industries, LLC, Stego Wrap Vapor Barrier.
 - b. W.R. Meadows Perminator – 15 mil.

- c. Poly-America Husky Yellow Guard – 15 mil.
 - d. Substitutions: Permitted upon approval of Architect/Engineer
- C. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751 or ASTM D994; Asphalt impregnated fiberboard or felt, 1/2 inch thick (unless noted otherwise in drawings); tongue and groove profile.
- B. Joint Filler Type B: ASTM D1752; recycled PVC.
- C. Joint Filler Type C: ASTM D1752; Premolded sponge rubber.
- D. Sealant and Primer: As specified in Section 079200.

2.5 CONCRETE MIX

- A. Select proportions for concrete in accordance with ACI 301 trial mixtures or field experience.
- B. Provide concrete to the following criteria:
 - 1. Exterior concrete exposed to deicing chemicals (Structural Stoop Slabs):

Material and Property	Measurement
Compressive Strength (7 day)	3000 psi
Compressive Strength (28 day)	4000 psi
Cement Type	ASTM C150
Cement Content (minimum)	658 pounds/cu yd
Aggregate Type	Normal weight
Water-Cement Ratio (maximum)	0.40 by weight
Aggregate Size (maximum)	1 inch
Aggregate Size (minimum)	1/2 inch
Air Content	6.0 percent to 8.5 percent
Fly Ash Content:	20 percent of cementitious materials by weight, maximum
Slump	4 inches maximum prior to water reducer 8 inches maximum after water reducer

- 2. Exterior concrete and concrete exposed to the weather or earth:

Material and Property	Measurement
Compressive Strength (7 day)	3000 psi
Compressive Strength (28 day)	4000 psi
Cement Type	ASTM C150
Cement Content (minimum)	658 pounds/cu yd
Aggregate Type	Normal weight
Water-Cement Ratio (maximum)	0.42 by weight
Aggregate Size (maximum)	1 inch
Aggregate Size (minimum)	1/2 inch
Air Content	6.0 percent to 8.5 percent
Fly Ash Content:	20 percent of cementitious materials by weight, maximum
Slump	4 inches maximum prior to water reducer 8 inches maximum after water reducer

3. Interior concrete:

Material and Property	Measurement
Compressive Strength (7 day)	3000 psi
Compressive Strength (28 day)	4000 psi
Cement Type	ASTM C150
Cement Content (minimum)	564 pounds/cu yd
Aggregate Type	Normal weight
Water-Cement Ratio (maximum)	0.45 by weight
Aggregate Size (maximum)	1 inch
Aggregate Size (minimum)	1/2 inch
Air Content	0 to 3 percent entrapped
Slump	4 inches maximum prior to water reducer 8 inches maximum after water reducer

C. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.

1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
2. Do not use calcium chloride nor admixtures containing calcium chloride.
3. Use set retarding admixtures during hot weather.

- 4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing, or deicing chemicals.
- 5. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fume, metakaolin, and slag content as required by ACI 318.
- D. Average Compressive Strength Reduction: Permitted in accordance with ACI 318.
- E. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94.
- F. Site Mixed Concrete: Not permitted

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent (where indicated on drawings). Remove laitance, coatings, and unsound materials.
- B. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- C. Remove water from areas receiving concrete before concrete is placed.
- D. Concrete can be place under water using tremie as approved by engineer.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Notify testing laboratory and Architect/Engineer minimum 48 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.
- D. Install vapor barrier under interior slabs on grade in accordance with ASTM E1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Level and compact base material
 - 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the Architect/Engineer or (b) where obstructed by impediments (such as dowels, water-stops, or any other site condition requiring early termination of the vapor barrier). At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - 3. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

4. Apply seam tape to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions
 6. Avoid the use of non-permanent stakes driven through vapor retarder.
 7. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
 8. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material of same or better permeance, puncture, and tensile strength; lap over damaged areas minimum 6 inches and seal watertight by taping joints.
- E. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler unless otherwise shown on the drawings.
- F. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- G. Extend joint filler from bottom of slab as required by Section 079200 for finish joint sealer requirements.
- H. Install joint covers in longest practical length, when adjacent construction activity is complete.
- I. Apply sealants in joint devices in accordance with Section 079200.
- J. Deposit concrete at final position. Prevent segregation of mix.
- K. Place concrete in continuous operation for each panel or section determined by predetermined joints.
- L. Consolidate concrete.
- M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- N. Place concrete continuously between predetermined expansion, control, and construction joints.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Place floor slabs in saw cut pattern indicated.
- Q. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- R. Screed floors and slabs on grade level, maintaining surface flatness of less than 1/8 inch in 10 feet. The minimum overall surface flatness shall be F_F35 , levelness shall be F_L25 , and local area minimums shall be F_F25 , F_L20 as determined by ASTM E1155.
- S. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal unless otherwise indicated on drawings. Areas that have floor drains shall not be required to meet the levelness tests.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces as follows:

1. 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.
 - a. Apply to concrete surfaces not exposed to public view.
 2. 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.
 - a. Apply to concrete surfaces exposed to public view.
 3. 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.
- B. Wood float surfaces receiving ceramic tile with full bed setting system.
- C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set ceramic tile.
- D. Steel trowel surfaces which are indicated to be exposed at interior spaces.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
1. Protect concrete footings from freezing until the concrete has reached the specified 28 day strength and a minimum of 5 days.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure concrete in accordance with ACI 308.1.
- D. Cure concrete and floor surfaces in accordance with ACI 301.
- E. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
- F. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.6 FIELD QUALITY CONTROL

- A. The **Owner** shall engage a qualified testing and inspecting agency to perform field special structural inspections and testing in accordance with the applicable International Building Code and to submit reports.
- B. The contractor shall be responsible for scheduling the tests. **The contractor shall be required to notify the owner's representative a minimum of 48 hours prior to all placement of**

concrete. The Contractor shall provide a minimum of 48 hours notification to the Special Inspector prior to needing an inspection. The Contractor shall verify all testing and Special Inspections have been completed and discrepancies corrected prior to covering the work.

- C. Provide free access to Work and cooperate with appointed firm. The Contractor shall provide access to the work so the Special Inspections and testing can be completed.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- E. Concrete Inspections:
 - 1. Continuous Placement Inspection: Inspect for proper installation procedures.
 - 2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- F. Strength Test Samples:
 - 1. Sampling Procedures: ASTM C172.
 - 2. Cylinder Molding and Curing Procedures: ASTM C31, 4"x8" cylinder specimens, standard cured.
 - 3. Sample concrete and make one set of five cylinders for every 75 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs.
 - 4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
- G. Field Testing:
 - 1. Slump Test Method: ASTM C143.
 - 2. Air Content Test Method: ASTM C231 for normal weight concrete or ASTM C173
 - 3. Temperature Test Method: ASTM C1064.
 - 4. Measure slump, density, and temperature for each compressive strength concrete sample.
 - 5. Measure air content in air entrained concrete for each compressive strength concrete sample.
 - 6. Density Testing ASTM C138.
- H. Cylinder Compressive Strength Testing:
 - 1. Test Method: ASTM C39.
 - 2. Test Acceptance: In accordance with ACI 301.
 - 3. Test one cylinder at 7 days.
 - 4. Test three cylinders at 28 days.
 - 5. Retain one cylinder for 56 days for testing when requested by Architect/Engineer.
 - 6. Dispose remaining cylinders when testing is not required.
- I. Core Compressive Strength Testing: Notify Architect/Engineer prior to core testing.
 - 1. Sampling and Testing Procedures: ASTM C42.
 - 2. Test Acceptance: In accordance with ACI 301.
 - 3. Drill three cores for each failed strength test from concrete represented by failed strength test. Locate reinforcing steel and avoid damaging reinforcing steel when cores are drilled.

- J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- C. Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or corrective work.

END OF SECTION 033000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 033543 - SPECIAL CONCRETE FLOOR FINISHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: This section specifies polished concrete (sealed).
- B. Related Sections:
 - 1. Section 079200 "Joint Sealants" for sealants in concrete floor surfaces

1.2 REFERENCES

- A. American Concrete Institute (ACI)
 - 1. ACI 302.1R – Guide for Concrete Floor and Slab Construction
- B. ASTM International
 - 1. ASTM C309 – Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
 - 2. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
 - 3. ASTM C779 – Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
 - 4. ASTM C805 – Standard Test Method for Rebound Number of Hardened Concrete
 - 5. ASTM E 1155 – Standard Test Method for Determining Floor Flatness and Levelness Using the F number system

1.3 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following
 - 1. Abrasion Resistance: ASTM C779, Up to 400% increase in abrasion resistance
 - 2. Reflectivity: Increase of 35% as determined by gloss meter
 - 3. Waterproof Properties: RILEM Test Method 11.4, 70% or greater reduction in absorption
 - 4. Impact Strength: ASTM C805, Up to 21% increased impact strength
 - 5. Must meet or exceed ADA/OSHA suggested 0.5 standard value for the Static Co-efficient of Friction
- B. Design Requirements
 - 1. Hardened Concrete Properties
 - a. Minimum Concrete Compressive Strength: 3500 psi
 - b. Normal Weight Concrete, No light weight aggregates
 - c. Non-air entrained concrete
 - 2. Placement Properties for New Concrete

- a. Natural concrete slump of 4 1/2 inches – 5 inches, Admixtures may be used
 - b. Flatness Requirements
 - 1) Overall Ff 50
 - 2) Local Ff 35
- 3. Hard-Steel Trowelled (3 passes) Concrete
 - a. No burn marks. Finish to ACI 302.1R, Class 5 floor
- 4. Curing Options
 - a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure). Acrylic curing and sealing compounds not recommended
 - b. Sheet membrane (ASTM C171) Polyethylene film not recommended
 - c. Damp curing: Seven day cure

1.4 PRE INSTALLATION MEETINGS

- A. Pre installation Conference: Conduct conference at project site

1.5 ACTION SUBMITTALS:

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

1.6 INFORMATIONAL SUBMITTALS

- A. Test Reports: Certified test reports, from an Independent Testing Laboratory, showing compliance with specified performance criteria and physical properties as cited in “Performance Requirements”
- B. Certificates:
 - 1. Product and installer certificates signed by the manufacturer certifying materials meet specified performance characteristics and criteria and physical requirements
 - 2. Current installation contractor’s certificate signed by manufacturer declaring contractor as a certified installer of polishing system, prior to bidding of project.

1.7 CLOSEOUT SUBMITTALS:

- A. Warranty: Submit warranty documents specified
- B. Maintenance Data: For polished concrete finishing to include in maintenance manuals. Also include the following
 - 1. Manufacturer’s instructions on maintenance renewal of applied treatments
 - 2. Protocols and product specifications for joint filling, crack repair and/or surface repair.

1.8 QUALITY ASSURANCE

- A. Manufacturers Qualifications:

1. Manufacturer has a minimum of 5 years experience in manufacturing components similar to or exceeding requirements of project.
 2. Manufacturer must be able to provide technically trained field representative during construction and approving application method
- B. Installer Qualifications
1. Installer experienced in performing work of this section who has specialized in installation work similar to that required for this project
 2. Installer trained and having current certification for Manufacturer's Concrete Polishing System
- C. Mock-Ups
1. Mock-up size: 10'x10' floor area at job site, at location as directed under conditions similar to those which will exist during actual placement. Divide mock-up area into 4 equal zones , allowing for sequential attempts to determine amount of aggregate exposure, and color (if required) and shine selection
 2. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, and shine level.
 3. Allow 24 hours for inspection of mock-up before proceeding with work
 4. When accepted, mock-up will demonstrate minimum standard of quality required for this project
- D. Cut and shine shall be as specified and designated below:
1. Class A - Cream Finish - little to no aggregate exposure including the fine sand
 2. Level 2 - Satin / Honed - producing a surface finish with a minimum DOI value of 55 and a minimum specular gloss value of 25.
- E. Sequence With Other Work: Comply with Manufacturer's written recommendations for sequencing construction operations

1.9 DELIVERY, STORAGE & HANDLING

- A. Ordering:
1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays
- B. Delivery:
1. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact
- C. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer
 2. Protect Concrete Slab
 - a. Protect from petroleum stains during construction
 - b. Diaper all hydraulic lifts and power equipment
 - c. Restrict vehicular parking, drop cloths will be placed under vehicles parked on slab

- d. No pipe cutting machinery will be used on interior floor slab
- e. Steel will not be placed on interior floor slab to avoid rust staining
- f. No acids or acidic detergents will come into contact with slab

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install work until ambient temperature and humidity conditions are maintained at levels indicated in reference standards

1.11 WARRANTY

- A. Project Warranty: Refer to Contract Conditions for project warranty provisions.
- B. Manufacturer's Warranty: Submit for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and does not limit, other rights Owner may have under Contract Documents

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. Ensure concrete finishing components and materials are from single source, from single manufacturer

2.2 POLISHED CONCRETE FINISHING PRODUCTS (SCF-1)

- A. Products/Systems:
 - 1. Hardener, Sealer, Densifier: penetrating, water based, odorless liquid, VOC compliant, environmentally safe chemical, will leave no film on surface.
 - a. Acceptable products:
 - 1) Prosoco – Consolidack LS.
 - 2) Laticrete – L&M Lion Hard.
 - 3) Nox-Crete – Duro-Nox LS
 - 2. Joint Filler: Semi-rigid, 2 component, self leveling, 100%solids, rapid curing, polyuria control joint and crack filler with a choice of 65, 75 or 85 Shore-A hardness.
 - 3. Cleaning Solution: As recommended by same manufacturer of hardener, sealer, and densifier.
 - 4. Stain Protector: As recommended by same manufacturer of hardener, sealer, and densifier.

PART 3 - EXECUTION

3.1 MANUFACTURERS INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installations and products Spec-Data sheets.

3.2 EXAMINATION

A. Site Verification of Conditions

1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of finishing materials
2. Verify concrete is cured to 28 days or 3500 psi strength

3.3 PREPARATION

- A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of Concrete finishing materials
- B. Examine surface to determine soundness of concrete for polishing

3.4 INSTALLATION

A. Floor Surface Polishing and Treatment

1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide Consistent finish in all contiguous areas
2. Apply floor finish prior to installation of fixtures and accessories
3. Diamond polish concrete floor surfaces with proper grinding equipment, recommended by Polishing system representative
 - a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of shine shall match that of approved mock-up.
 - b. Expose aggregate in concrete surface only as determined by approved mock-up
 - c. All concrete surfaces shall be as uniform in appearance as possible
4. Apply Hardener, Densifier as follows;
 - a. Apply Hardener at 200 sq. ft. per gallon, according to manufacturer's directions
 - b. Apply guard according to manufacturer's directions
 - 1) Remove defects and re-polish defective areas
 - 2) Finish edges of floor finish adjoining other materials in a clean and sharp manner

3.5 FINAL CLEANING

- A. Mechanically scrub treated floors for seven days with soft to medium pads using approved cleaning solution
- B. Upon completion, general contractor must remove surplus and excess materials, rubbish, tools and equipment

3.6 PROTECTION

- A. Protect installed product (Polished floors) from damage during construction

END OF SECTION 033543

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Reinforcement, anchorage, and accessories.
 - 2. Facing brick units.
- B. Related Divisions are 02 through 33.

1.3 REFERENCE STANDARDS

- A. The Masonry Society:
 - 1. TMS 402/602 - Building Code Requirements and Specifications for Masonry Structures.
- B. ASTM International:
 - 1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 3. ASTM A615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 - 4. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
 - 6. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - 7. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
 - 8. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - 9. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
 - 10. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
 - 11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 12. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 COORDINATION

- A. Coordinate Work of this Section with veneer and installation of window and door anchors.
- B. Direct and coordinate placement of metal anchors supplied to other Sections.

1.5 PREINSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing Work of this Section.

1.6 SUBMITTALS

- A. Product Data:
 - 1. Submit data for masonry units, fabricated wire reinforcement, wall ties, anchors and other accessories.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement, and accessories.
- C. Samples:
 - 1. Submit (3) bricks with product data for approval.
 - 2. Submit custom mortar to match Architect's sample for approval.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Qualifications Statements:
 - 1. Submit manufacturer's approval of installer.

1.7 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of materials if materials are supplied by more than one manufacturer.
- B. Operation and Maintenance Data: Submit cleaning and care instructions.

1.8 QUALITY ASSURANCE

- A. Structural Tests and Special Inspections: Conform to International Building Code (IBC) Chapter 17 and IBC Chapter 21 for special inspections and quality assurance verification testing of compressive strength of each unit masonry wythe using applicable unit strength method.
- B. Perform Work according to the referenced building code and local standards.
- C. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame-spread/smoke-developed index when tested according to ASTM E84.

- D. Apply label from agency approved by authority having jurisdiction to identify each foam-plastic insulation insert.
- E. Perform work in accordance with specified codes and manufacturer standards.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Inspect units for damage. Do not use damaged units in the work.

1.11 AMBIENT CONDITIONS

- A. Cold Weather Requirements: Conform to TMS 602 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- B. Hot Weather Requirements: Conform to TMS 602 when ambient temperature is greater than 100 degrees F, or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 miles per hour.

PART 2 - PRODUCTS

2.1 UNIT MASONRY

- A. Furnish materials according to the building code and local standards.
- B. Description:
 - 1. Clay Masonry Unit Compressive Strength (f'm): Minimum 1500 psi minimum net area compressive strength as determined by unit strength method.

2.2 MATERIALS

- A. Facing Brick: ASTM C216, Grade SW, Type FBX
 - 1. Basis of design manufacturer: ACME Brick; Color: Garnet; Texture: Smooth;.
 - 2. Other acceptable manufacturers:
 - a. General Shale Brick – Color: Red Smooth Select.
 - b. US Brick – Color: Cherry Smooth.
 - 3. Size: Modular

4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated “Not effloresced”.
5. Compressive strength: 2000 psi; determined by unit strength method.

2.3 ACCESSORIES

- A. Single Wythe Joint Reinforcement: ASTM A951; ladder type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot-dip galvanized.
- B. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, uncoated finish.
- C. Reinforcing Bar Positioners: Cold-drawn steel wire, 11 gage, ASTM A153, hot-dip galvanized designed to prevent displacement of reinforcing steel and maintain adequate grout coverage within unit masonry cells.
 1. Vertical Bar: Fabricate for positioning each vertical bar lap splice.
- D. Anchor Rods: ASTM A307, Grade A (60 yield strength); Headed type; complete with washers and heavy hex nuts; sized for minimum 15-in embedment; galvanized finish.
 1. Hot-Dip Galvanizing: ASTM A153.
- E. Mortar and Grout: Do not use admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
 3. 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.
 4. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
 - a. 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.
 - b. Custom mortar mix to match Architect’s sample.
 5. Grout for Unit Masonry: Comply with ASTM C 476. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M
- F. Pigments for Colored Mortar: Iron or chromium oxides with demonstrated stability and colorfastness.
 1. Color: Match Architect’s sample.
- G. Masonry Control Joint, Expansion Joint, and Relief Angle Sealant: Double weather seal, as specified Section 079200 - Joint Sealants.
- H. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding; maximum length by the width indicated on the drawings.

- I. Cleaning Solution: Commercial masonry cleaner that is not harmful to masonry or adjacent materials. Conform to manufacturer instructions. Muriatic acid and other acidic solutions not permitted.
- J. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.
- K. Flexible Flashings: Flexible, self-adhering through wall flashing material, 40-mil overall thickness, synthetic rubber based with cross-laminated polyethylene cover. Provide "Perm-A-Barrier Flashing" by Grace Construction Products or approved equivalent.
- L. Weep Vent: Plastic Non-woven Mesh Vent; color to match mortar.
- M. Drip edge: Stainless steel ASTM A 240, Type 304, Soft temper; 0.016 inch thick, smooth finish.
- N. Cavity Drain Material:
 - 1. Basis of design Manufacturer: Mortar Net Solutions – CellVent.
 - 2. Other acceptable manufacturers:
 - a. MASONPRO – ProNet DT.
 - b. Hohmann & Barnard – Mortar Net
 - 3. Description: Open Polyethylene Mesh, thickness as required to fill cavity space, shaped to ensure moisture drainage to weep vents.

2.4 SOURCE QUALITY CONTROL

- A. Testing: Test brick efflorescence according to ASTM C67. Brick rated greater than "slightly effloresced" is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive Work prior to beginning.
- B. Verify items provided by other Sections of Work are properly sized and located.
- C. Verify built-in items are in proper location and ready for roughing into masonry work.
- D. Verify masonry units free of cracks, spalling, disfigurements, face chips, or edge chips in excess of 1/4 inch in length or depth. Clean free of bond breakers and other foreign substances.

3.2 PREPARATION

- A. Wet clay and shale brick before setting in place when initial rate of absorption is greater than 30 g when tested according to ASTM C67.

3.3 INSTALLATION

- A. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
- B. Establish lines, levels, and coursing indicated. Protect from displacement.
- C. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.
- D. Align exposed exterior faces of masonry flush, allowing block thickness variations to appear on unexposed interior face.
- E. At exposed interior walls and single wythe walls where both faces are exposed, adjust to reduce appearance of irregular block thickness.
- F. Coursing of Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
- G. Placing and Bonding:
 - 1. Lay solid masonry units in full bed of mortar with full head joints.
 - 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 - 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 - 4. Remove excess mortar as Work progresses.
 - 5. Interlock intersections and external corners.
 - 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
 - 7. Perform job-Site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 - 8. Isolate masonry from vertical structural framing members with movement joint as indicated on Drawings.
 - 9. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- H. Weeps and Vents
 - 1. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches o.c. horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
 - 2. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier adhesive.
 - a. Install cavity drain material continuously at bottom of each cavity above through-wall flashing.
- I. Joint Reinforcement and Anchorage:
 - 1. Install horizontal joint reinforcement 16 inches o.c.

2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
6. Reinforce joint corners and intersections with premanufactured L-shaped and T-shaped horizontal joint reinforcement at 16 inches o.c.

J. Masonry Flashings:

1. Extend flashings horizontally through outer wythe above ledge or shelf angles and lintels under parapet caps at bottom of walls and turn down on outside face to form drip.
2. Turn flashing up minimum 8 inches and seal to cavity insulation over inner wythe.
3. Lap end joints minimum 6 inches and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.
5. Whether or not specifically indicated install flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - a. Extend flashings full width at such interruptions.
 - b. Remove or cover protrusions or sharp edges that could puncture flashings.
 - c. Seal lapped ends and penetrations of flashing before covering with mortar.

K. Lintels:

1. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
2. Openings up to 42 inches Wide: Place two, No. 4 reinforcing bars 1 inch from bottom web unless noted otherwise.
3. Openings Over 42 inches: Reinforce openings as indicated on Drawings.
4. Do not splice reinforcing bars.
5. Support and secure reinforcing bars from displacement.
6. Place and consolidate grout fill without displacing reinforcing.
7. Allow masonry lintels to attain specified strength before removing temporary supports.
8. Maintain minimum 8 inch bearing on each side of opening.

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
- L. Limit height of vertical grout pours to not more than 60 inches.
- M. Install Products in Accordance with Manufacturer's Instructions
1. Reinforce bond beam as indicated on Drawings with reinforcing 1 inch from bottom web.
 2. Lap splices' bar diameters as indicated on the drawings and required by code.
 3. Support and secure reinforcing bars from displacement.
 4. Place and consolidate grout fill without displacing reinforcing.
 5. At bearing locations, fill masonry cores with grout for minimum 8 inches either side of opening.
- N. Reinforced Masonry:
1. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
 2. Place reinforcing, reinforcement bars, and grout as indicated on Drawings.
 3. Splice reinforcement as indicated on the drawings.
 4. Support and secure reinforcement from displacement.
 5. Place and consolidate grout fill without displacing reinforcing.
 6. Place grout according to TMS 602.
- O. Control and Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
 - a. Exterior Walls: 20 feet o.c. and within 48 inches on one side of each interior and exterior corner.
 - b. Interior Walls: 30 feet o.c.
 - c. At changes in wall height.
 2. Do not continue horizontal joint reinforcement through control and expansion joints.
 3. Form control joint with sheet building paper bond breaker fitted to one side of hollow-contour end of block unit. Fill resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant, or install preformed control joint device in continuous lengths. Seal butt and corner joints.
 4. Size control joint according to Section 079200 Joint Sealants for sealant performance.
 5. Form expansion joint by omitting mortar and cutting unit to form open space.
- P. Built-in Work:
1. As Work progresses, install built-in metal door and glazed frames, anchor bolts, plates and other items to be built in the Work and furnished by other Sections.
 2. Install built-in items plumb and level.
 3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.
 4. Do not build in materials subject to deterioration.

Q. Cutting and Fitting:

1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of Work to provide correct size, shape, and location.
2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

R. Cleanouts at Solid-Grouted, Hollow-Core Masonry:

1. Locate at bottom course of each grout lift at each vertical reinforcing bar with maximum 32 inches on centers at solid grouted walls for grout pours exceeding 5 feet in height, according to TMS 602.
2. Make cleanout by removing and reinstalling entire face of masonry unit at exterior wall surfaces.
3. Clean grout space prior to grouting to remove mortar droppings, mortar projections larger than 1/2 inch, and other foreign matter.
4. Seal cleanouts after inspection and before grouting.

3.4 ERECTION TOLERANCES

- A. Maximum Variation from Alignment of Columns and Pilasters: 1/4 inch.
- B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet, 3/8 inch in 20 feet, and 1/2 inch in 30 feet or more.
- D. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.
- H. Maximum Variation for Steel Reinforcement:
1. Install reinforcement within the tolerances specified in TMS 602 for foundation walls.
 2. Plus or minus 1/2 in when distance from centerline of steel to opposite face of masonry is 8 in or less.
 3. Plus or minus 1 in when distance is between 8 and 24 in.
 4. Plus or minus 1-1/4 in when distance is greater than 24 in.
 5. Vertical reinforcement plus or minus 2 in from location along length of wall.

3.5 FIELD QUALITY CONTROL

- A. Inspectors: **Owner** will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform

inspections. Inspections shall be performed per Tables 3 and 4 - Level 2 Quality Assurance (Special Inspection), TMS 602.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: **Owner** will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
 1. Payment for these services will be made by **Owner**.
- C. The Contractor shall provide a minimum of 48 hours notification to the Special Inspector prior to needing an inspection. The Contractor shall provide access to the work so the Special Inspections can be completed. The Contractor shall verify all Special Inspections have been completed and discrepancies corrected prior to covering the work.
- D. Testing Frequency: Prior to construction. One set of tests for each 5000 sq. feet. of wall area or portion thereof.
- E. Test each type of concrete masonry units according to ASTM C140.
- F. Cut out damaged and defective work, reconstruct with new masonry materials, and repoint with mortar.
- G. Remove excess mortar on masonry and adjacent surfaces.

3.6 CLEANING

- A. Remove excess mortar and mortar smears as Work progresses.
- B. Replace defective mortar. Match adjacent Work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.7 PROTECTION

- A. Hot and Cold Weather Construction: Perform Work according to TMS 602, 1.8.
- B. Protect exposed external corners subject to damage.
- C. Protect base of walls from mud and mortar splatter.
- D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.
- E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when Work is not in progress.
- F. Protect Work from rain by performing Work under protective cover.

END OF SECTION 042000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preservative treatment of wood.
 - 2. Miscellaneous framing – wood blocking.
- B. Related Divisions are 02 through 33.

1.3 REFERENCE STANDARDS

- A. American Wood Protection Association:
 - 1. AWP A M4 - Standard for the Care of Preservative-Treated Wood Products.
 - 2. AWP A U1 - Use Category System: User Specification for Treated Wood.
- B. APA - The Engineered Wood Association:
 - 1. APA PS1 - Voluntary Product Standard for Construction and Industrial Plywood.
 - 2. APA - Plywood Design Specification, including supplements.
- C. ASTM International:
 - 1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - 3. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
 - 4. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 7. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- D. U.S. Department of Commerce National Institute of Standards and Technology:
 - 1. DOC PS 1 - Construction and Industrial Plywood.
 - 2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.

3. DOC PS 20 - American Softwood Lumber Standard.

1.4 SUBMITTALS

- A. Product Data: Submit technical data on insulated sheathing, wood preservative materials, and application instructions.

1.5 QUALITY ASSURANCE

- A. Perform Work according to the following:
 1. Lumber Grading Agency: Certified by DOC PS 20.
 2. Wood Structural Panel Grading Agency: Certified by APA-The Engineered Wood Association.
 3. Lumber: DOC PS 20.
 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Fire-Rated Wall, Floor, and Roof Construction: Rating as indicated on Drawings.
 1. Tested Rating: Determined according to ASTM E119.
- C. Apply label from agency approved by authority having jurisdiction to identify each preservative-treated and fire-retardant-treated material.
- D. Use adequate numbers of skilled workmen (workwomen) who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- E. Perform Work according to state and local standards.

PART 2 - PRODUCTS

2.1 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products:
 1. Manufactured with an exterior-type adhesive complying with ASTM D 2559.
 2. Evaluated and monitored according to ASTM D 5456.
- B. Types:
 1. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths.
 2. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Indoor Environmental Quality Characteristics:

1. Interior Composite Wood Products: Contain no added urea formaldehyde resins.

2.3 LUMBER MATERIALS

- A. Lumber Grading Rules: APA.
- B. Treated Lumber: Southern Pine (SP) species, #2 grade, dimension lumber, 19 percent maximum moisture content, pressure-preservative treated, unless noted otherwise on the drawings.
- C. Miscellaneous Framing: Spruce-Pine-Fir (SPF) species, #2 grade, dimension lumber, 19 percent maximum moisture content.

2.4 FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWWA U1, commodity specification A-sawn products or F-wood composites using waterborne SBX preservative.
- B. Fire-Retardant Treatment: Chemically treated and pressure impregnated; having flame spread of 25 or less when tested according to ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20-minute period; interior type.
- C. Moisture Content after Treatment: Re-dried or Kiln dried (KDAT).
 1. Lumber: Maximum 19 percent.

2.5 ACCESSORIES

- A. Fasteners and Anchors:
 1. Fasteners: ASTM A153, hot-dip galvanized, ASTM B695, Class 55 mechanically galvanized, or stainless steel for high-humidity and treated wood locations, unfinished steel elsewhere.
 2. Nails: ASTM F1667.
- B. Die-Stamped Connectors: As indicated on the drawings, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION

- A. Workmanship:

1. Produce joints which are tight, true, and well nailed, with members assembled in accordance with the Drawings and with pertinent codes and regulations.
2. Lumber may be rejected by the Engineer/Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.
3. Do not shim any framing component.

B. Framing:

1. Carefully select all members. Select individual pieces so that knots and defects will not interfere with placement of bolts, when nailing or making connections. Discard defective pieces.
2. Set structural members level and plumb, in correct position.
3. Fasten framing according to applicable code.
4. Make provisions for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
5. Place horizontal members, crown side up.
6. Construct load-bearing framing and curb members full length without splices.
7. Double members at openings over 24 inches wide. Space short studs over and under opening to stud spacing.
8. Construct double joist headers at floor and ceiling openings and under wall stud partitions parallel to floor joists. Frame rigidly into joists.
9. Install shear wall panels to comply with manufacturer's written instructions.
10. Bridge joists and rafters in excess of 8 feet span at 8 feet on centers maximum. Fit solid blocking at ends of members.
11. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
12. Coordinate curb installation with installation of decking and support of deck openings and roofing vapor retardant.
13. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install wood blocking and backing required for the work of other trades.
14. Do not notch, cut, or bore members for pipes, ducts, or conduits, or for other reasons except as shown on the Drawings or as specifically approved in advance by the Engineer/Architect.

C. FASTENING

1. Nailing Schedule: Unless otherwise directed by the Engineer/Architect, comply with nailing requirements stipulated by the current edition of the International Building Code.
2. Nailing:
 - a. Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise specifically noted on the Drawings.
 - b. For conditions not covered in the Nailing Schedule provide penetration into the piece receiving the point of not less than $\frac{1}{2}$ the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2" (nominal) thickness.
 - c. Nail without splitting wood.
 - d. Prebore as required.
 - e. Remove split members and replace with members complying with the specified requirements.

3. Bolting:
 - a. Drill holes 1/16" larger in diameter than the bolts being used.
 - b. Drill straight and true from one side only.
 - c. Do not bear bolt heads on wood, but use washers under head and nut where both bear on wood, and use washers under all nuts.
 4. Screws:
 - a. For lag screws and wood screws, prebore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.
 - b. Screw, do not drive, lag screws and wood screws.
- D. Site-Applied Wood Treatment:
1. Brush-apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings, and masonry materials.
 2. Treat Site-sawn cuts. Apply preservative to Site-sawn cuts according to AWPA M4.
 3. Allow preservative to dry prior to erecting members.

3.3 TOLERANCES

- A. Framing and Furring Members to Receive a Finished Wall, Floor, or Ceiling: Align finish surface to vary not more than 1/8 inch from a theoretical plane or surfaces of the room or space.
- B. Other Framing Members: 1/4 inch from indicated position, maximum.
- C. Surface Flatness of Floor: 1/4 inch in 10 feet minimum, and 1/2 inch in 30 feet maximum.

END OF SECTION 061000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 066140 - SOLID SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Counter tops.
 - a. Solid-surface countertops.
 - 2. Prefinish the Work of this Section.
- B. Related Requirements:
 - 1. Section 061000 - Rough Carpentry: Grounds and support framing.

1.2 REFERENCE STANDARDS

- A. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- C. South Coast Air Quality Management District:
 - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 PREINSTALLATION MEETINGS

- A. Section 013100 - Coordination: Requirements for preinstallation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals, including AWS Section 1.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details and attachments to other work. Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, schedule of finishes, and Certified Compliance Label on each set.

C. Samples:

1. Submit two samples, for each solid surface finish.

D. Qualification Statements:

1. Submit qualifications for fabricator and licensed professional.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics: Comply with the following when tested according to NFPA 286.

1. During 40 kW Exposure: No flame spread to ceiling.
2. During 160 kW Exposure: No flame spread to perimeter of tested sample and no flashover.
3. Total Smoke Release: Maximum 1 000 cu m.

B. Perform Work in accordance with specified building codes.

C. Maintain 1 copy of each standard affecting the Work of this Section on-Site.

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum five years' documented experience similar to this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.8 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient conditions control facilities for product storage and installation.

B. Maintain storage space relative humidity within ranges indicated in AWS Section 2.

C. Subsequent Conditions: Maintain same temperature and humidity conditions in building spaces as will occur after occupancy during and after installation of Work of this Section.

1.9 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOLID SURFACING

A. Solid Surface Countertops:

1. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
2. Manufacturers: Subject to compliance with requirements, provide the basis of design products as indicated on the drawings and schedules or submit an equal product to be approved by the architect.
 - a. Basis of Design: Dupont Corian
 - b. Other acceptable manufacturers:
 - 1) Samsung.
 - 2) Lotte Chemical – Staron Solid Surfaces.
 - c. Color: As indicated on drawings and schedules
 - d. Edge: Eased
 - e. Thickness: 1/2 inch for counters;.

2.2 FABRICATION

- A. Shop-assemble casework for delivery to Site in units easily handled and to permit passage through building openings.
- B. When necessary to cut and fit on-Site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and Site cutting.

2.3 ACCESSORIES

A. Fasteners and Anchors:

1. Fasteners: ASTM A153, hot-dip galvanized steel for high-humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

- B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with Work of this Section.

3.2 PREPARATION

- A. Prime paint surfaces of woodwork items and assemblies to be in contact with cementitious materials.

3.3 INSTALLATION

- A. Set and secure casework, interior finish carpentry, and counter tops in place; rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall-mounted components.
- C. Use concealed joint fasteners to align and secure adjoining counter tops.
- D. Install work in accordance with trade standards.

3.4 TOLERANCES

- A. Conform to AWS Sections 6 and 10 requirements for the following:
 - 1. Smoothness.
 - 2. Gaps.
 - 3. Flushness.
 - 4. Flatness.
 - 5. Alignment

3.5 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING

- A. Section 017400 - Cleaning: Requirements for cleaning.
- B. Clean counters and fixtures.

END OF SECTION 066140

SECTION - 079200 JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide sealing and caulking of joints, including fire separations, joint fillers and accessories, shown on the drawings.

1.2 QUALITY ASSURANCE

- A. Qualifications of installers: Employ only experienced craftsmen, skilled in the installation of specified products. Confirm sealant specified is compatible with adjacent surfaces.

1.3 REFERENCES

- A. Manufacturer's catalogs: The acceptable manufacturer's catalogs, current at date of bidding documents, are incorporated by reference to the same force and effect as if repeated herein at length.

1.4 DELIVERY, STORAGE & HANDLING

- A. Deliver all products in manufacturer's original containers, with seals unbroken, labels, product and manufacturer's names intact and legible.
- B. Store all products in a manner to prevent damage, in a secure place, out of way of construction operations. Provide protection until ready for use.
- C. Handle in accord with manufacturer's recommendations.

1.5 PROJECT/SITE CONDITIONS

- A. Environmental conditions:
 - 1. Weather: Do not install products during adverse weather conditions.
 - 2. Temperature: Ensure that surface and ambient temperatures and humidity are within the range recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Use only the specified products of the following manufacturers:

1. DOW: DOW Chemical Co., Midland, MI.
2. MAM: Mameco International, Cleveland, OH.
3. SIKA: Sika Chemical Corp., Lyndhurst, NJ.
4. SON: Contech, Inc., Sonneborn Building Products Div., Minneapolis, MN.
5. TREM: Tremco Manufacturing Co., Cleveland, OH.

2.2 SEALANTS (EXTERIOR & INTERIOR)

A. Generic description and Use:

1. S-1: One component urethane, non-sag, gun grade elastomeric sealant. Use in all joints one-inch wide or less wherever movement may occur on interior or exterior, at contraction and expansion joints, masonry to masonry, concrete building construction joints, metal door and window frames to wood, metal to metal and sheet metal to wood.

B. Acceptable products:

1. SIKA: Sikaflex 15LM.
2. SON: Sonalastic NPI.
3. DOW: DOWSIL 790

2.3 CAULKS (INTERIOR ONLY)

A. Generic description:

1. C-1: One part acrylic gun grade.

B. Acceptable products:

1. SIKA: Sikaflex 420.
2. SON: Sonalac acrylic latex caulk.
3. TREM: Acrylic latex caulk.

2.4 SELF-LEVELING SEALANT

A. Generic description:

1. NP-2: single component, self-leveling, premium grade polyurethane sealant

B. Acceptable products:

1. SIKA: Sikaflex Self-Leveling Sealant
2. BASF: MasterSeal SL-1
3. SON: Sonomeric Self Leveling Sealant

2.5 FIRE RESISTIVE SEALANT

A. Generic description:

1. Elastomeric, ready-to-use, single component, neutral-cure silicone sealant.
2. Provide a firestop system with an assembly rating as determined by ASTM E 1966 which is equal to the fire-resistance ratings of the construction in which the joint occurs and noted on drawings.

B. Acceptable products:

1. 3M: Fire Barrier Silicone Sealant 2000+
2. HILTI: Flexible FireStop Sealant CP 606
3. SIKA: FireSil 670 Fire

2.6 JOINT FILLERS

A. Generic Description & Use:

1. JF-1: Backer rod for elastomeric sealants. Extruded closed-cell polyethylene foam or polyethylene jacketed polyurethane foam, non-bleeding, non-staining, oversized 30 to 50 percent. Does not bond to sealant.

B. Acceptable products:

1. DOW: Ethafoam.
2. MEAD: Backer Rod.
3. SON: Sonofoam Backer Rod.
4. WIL: Expand-O-Foam Cord.

2.7 JOINT CLEANER

- ### **A.**
- Type recommended by the manufacturer of the sealing or calking compound for the specific joint surface and condition.

2.8 BOND BREAKER

- ### **A.**
- Polyethylene tape; pressure sensitive recommended by sealant manufacturer to suit application.

2.9 SEALANT PRIMER

- ### **A.**
- Provide prime per manufacturer recommendations.

PART 3 - EXECUTION

3.1 INSPECTION

- ### **A.**
- Thoroughly inspect all existing construction and the conditions under which the work will

be performed. Report to the Architect/Engineer in writing all conditions that would adversely affect installation of the work.

- B. Verify that all joint dimensions are in accord with manufacturer's recommendations. Report discrepancies to architect.
- C. Start of work constitutes contractor's acceptance of construction and conditions.

3.2 PREPARATION

- A. Clean, prepare and size joints in accord with manufacturer's instructions. Remove all loose materials and other foreign matter which might impair adhesion of sealant or calking.
- B. Prior to installing sealants in horizontal joints where asphalt impregnated expansion joint fillers or other non-polyethylene joint fillers have already been placed, duct tape or polyethylene tape may be placed directly over the existing filler.

3.3 INSTALLATION

- A. Comply with sealant manufacturer's printed instructions.
- B. Install sealant backer rod for liquid elastomeric sealants.
- C. Install bond breaker tape wherever recommended by manufacturer to ensure that elastomeric sealants will perform properly.
- D. Install sealants and calking in uniform, continuous ribbons, without gaps or air pockets. Ensure complete "wetting" of the joints. Bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
- E. Install sealants to depths shown; when not shown, within the following limitations:
 - 1. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but not more than 1/2" deep or less than 1/4" deep.
 - 2. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75% to 125% of joint width.
- F. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces.
 - 1. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces.

3.4 CURING

- A. Cure sealants and calking compounds in compliance with manufacturer's instructions to obtain high early bond strength, internal cohesive strength and surface durability.

3.5 IDENTIFICATION & DOCUMENTATION OF FIRE-RESISTIVE SEALANT

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.

- 1. The documentation form for construction joints is to include:

- a. A sequential location number.
 - b. The project name.
 - c. Date of installation.
 - d. Detailed description of the construction joint's location.
 - e. Tested system or engineered judgment number.
 - f. Type of construction joint.
 - g. The width of the joint.
 - h. The lineal footage of the joint.
 - i. Number of sides addressed.
 - j. Hourly rated to be achieved.
 - k. Installer's name.

- 2. Copies of these documents are to be provided to the general contractor at the completion of the project.
 - 3. Permanently attach identification labels to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping.

3.6 ADJUST/CLEAN

- A. Upon completion, carefully examine all sealant and caulking work. Remove all damaged and defective work and replace with new materials.
- B. Clean up. Remove all surplus products, containers and rubbish and dispose of offsite.
- C. Remove all spilled or spattered materials from all surfaces. When adjacent surfaces or other work has been damaged or stained as a result of sealing and caulking work, repair all damage and remove all stains to the satisfaction of the Architect/Engineer.

3.7 PROTECTION

- A. Protect installed work during remainder of construction period. Ensure that it will be without damage or deterioration (other than normal wear or weathering) at substantial completion.

END OF SECTION 079200

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 081100 - METAL DOOR FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior thermally broken and interior steel frames.

1.2 RELATED SECTIONS

- A. Section 081300 – Metal Doors.
- B. Section 087100 – Door Hardware.
- C. Section 088000 – Glazing.

1.3 REFERENCES

- A. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ASTM A525 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- D. NFPA 80 – Fire Doors and Windows.
- E. SDI-100 – Standard Steel Doors and Frames.
- F. UL 10B – Fire Tests of Door Assemblies.

1.4 SUBMITTALS FOR REVIEW

- A. Section 013300 – Submittals: Procedures for submittals.
- B. Product Data: Indicate frame configuration and finishes.
- C. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacings, location of cut-outs for hardware, and finish.

1.4 QUALITY ASSURANCE

- A. Conform to requirements of SDI-100 and ANSI A117.1.
- B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Accept frames on site in manufacturer's packaging. Inspect for damage.

PART 2 – PRODUCTS

2.1 FRAME MANUFACTURERS

- A. Steelcraft.
- B. Ceco.
- C. Curries.

2.2 FRAMES

- A. Exterior Frames: Thermally broken, 16 gauge, face-welded type.
- B. Interior Frames: 16 gauge, drywall type.

2.3 ACCESSORIES

- A. Silencers: Resilient rubber fitted into drilled hole.
- B. Weatherstripping: Specified in Section 087100.

2.4 FABRICATION

- A. Fabricate drywall frames as welded units, set before the installation of drywall.
- B. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- D. Prepare frames for silencers. Provide three single silencers for single doors. Provide two single silencers on frame head at double doors without mullions.
- E. Attach UL fire rated label to each fire rated door unit.

2.5 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 G60.
- B. Primer: Air dried or baked for interior frames.
- B. Finish Coat: Powder coat.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI-100 and DHI.
- B. Coordinate with masonry, masonry, metal wall panel, PEMB wall construction for anchor placement.
- C. Coordinate installation of frames with installation of hardware specified in Section 087100.

3.2 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

END OF SECTION 081100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 081300 - METAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Non-rated thermally insulated steel doors.
- B. Non-rated steel doors.

1.2 SUBMITTALS

- A. Section 013300 - Submittals: Procedures for submittals.
- B. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.
- C. Shop Drawings: Indicate door elevations, internal reinforcement, closure method.

1.3 RELATED SECTIONS

- A. Section 081100 – Metal Door Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 – Glazing.

1.4 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. DHI (Door Hardware Institute) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- D. SDI-111 - Standard Steel Doors and Frames.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of SDI-111 and ANSI A117.1.
- B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Accept doors on site in manufacturer's packaging. Inspect for damage.
- B. Break seal on site to permit ventilation.

PART 2 - PRODUCTS

2.1 DOOR MANUFACTURERS

- A. Steelcraft CE Series.
- B. Curries 707 Series.
- C. Republic DL Series.

2.2 DOORS

- A. Exterior Doors (Thermally Isolated): SDI-111 Level III, Model 1, 16 gage.
- B. Interior Doors (Non Rated): SDI-118 Level III, Model 1, 16 gage.

2.3 DOOR CONSTRUCTION

- A. Face: Steel sheet, flat panel door.
- B. End Closure: Channel, 0.047 inches thick, flush. Tops and bottoms shall be closed and made water-tight.
- C. Core: Polyurethane for exterior doors.

2.4 FABRICATION

- A. Fabricate doors with hardware reinforcement welded in place.

2.5 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 G60.
- B. Primer: Air dried or baked.
- C. Finish Coat: Powder coated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with SDI-111 and DHI.
- B. Install doors, plumb and level.
- C. Coordinate installation of doors with installation of frames specified in Section 081100 and hardware specified in Section 087100.

3.2 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 ADJUSTING

- A. Adjust door for smooth and balanced door movement.

END OF SECTION 081300

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior storefront framing.
 - 2. Exterior manual-swing entrance doors and door frame units.
 - 3. Storefront framing for punched openings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
- C. Samples: For each type of exposed finish required.
- D. Other Action Submittals:
 - 1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.
- E. Maintenance data.
- F. Warranties: Sample of special warranties.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
- B.
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - 4.
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Failure of operating units.

- C. Wind Loads: As indicated on Drawings.
- D. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller.
- E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
 - 1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 2. Test Durations: 10 seconds.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 8 lbf/sq. ft.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- E. Accessible Entrances: Comply with applicable provisions in the 2010 ADA and 1997 Illinois Accessibility Code.
- F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or 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 MANUFACTURERS

- A. Manufacturers:
 - 1. Exterior Storefront, Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 451T or equal from one of the approved manufacturers.
 - 2. Other acceptable Manufacturers:
 - a. EFCO Corporation.
 - b. Traco.
 - c. Vistawall Architectural Products.
 - d. YKK AP America, Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction:
 - a. Exterior Storefront System: Thermally broken, 2" x 4-1/2".
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated on elevations.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads (stainless steel).

- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 – Glazing.
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Exterior Door Construction: 2-1/4-inch overall thickness, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 2.
 - a. Basis of Design Product: Kawneer AA425 Thermal Entrances.
 - b. EFCO Series D502 Swing Entrance Doors.
 - c. Vistawall Merit Thermal Swing Entrance Doors.
 - d. YKK MegaTherm 50XT Thermal Commercial Entrances.
 - 3. Door Design: Wide stile; 5-inch nominal width.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 - 4. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - 5.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in this section and Section 087100 – Door Hardware.
- C. Weather Stripping: Manufacturer's standard replaceable components.

2.6 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from exterior.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Entrance Door Frames: Reinforce to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Anodized Dark Bronze Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 – Joint Sealants to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Provide plastic shim backer full length of framing. Install low expansions, spray foam around perimeter of window.
- G. Install glazing as specified in Section 088000 – Glazing.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
2. Electronic access control system components, including:
 - a. Electronic access control devices.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
2. Section 081113 – Hollow Metal Doors.
3. Division 26 sections for connections to electrical power system and for low-voltage wiring.
4. Division 28 sections for coordination with other components of electronic access control system.

1.2 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.3 SUBMITTALS

A. General:

1. Submit in accordance with Section 013300 – Submittals.

2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
5. Key Schedule:
 - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.

- b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
- 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance:
 - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.
- 4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
- 5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

- 1. Operations and Maintenance Data: Provide in accordance with Section 017000 – Execution and Closeout Requirements: Closeout procedures and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Parts list for each product.
 - d. Final approved hardware schedule, edited to reflect conditions as-installed.

- e. Final keying schedule
- f. Copies of floor plans with keying nomenclature
- g. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- h. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.4 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
 - 1. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 - 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 - 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 - 4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier's Architectural Hardware Consultant.
 - 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- K. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.

L. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

- A. Section 013300 – Coordination: Coordination and project conditions.
- B. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- D. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- E. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- F. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- G. Direct shipments not permitted, unless approved by Contractor.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - c. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - d. Continuous Hinges: Lifetime warranty.
 - e. Key Blanks: Lifetime
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.8 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
 1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
 2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
 3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.

2.3 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Markar, Stanley, National Guard Products HD1100 & HD 2400.
2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.25, Grade 2.
 - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
 - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 - d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
 - e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 - f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
 - g. Install hinges with fasteners supplied by manufacturer.
 - h. Provide hinges with symmetrical hole pattern.

2.4 ELECTRIC POWER TRANSFER

- A. Manufacturers:
 - a. Scheduled Manufacturer: Von Duprin.
 - b. Acceptable Manufacturers: Falcon, ABH.
- B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
- C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.5 EXIT DEVICES

A. Manufacturer and Product:

1. Scheduled Manufacturer: Von Duprin 98 series.
2. Acceptable Manufacturers and Products: Falcon 25/24 series, Sargent 80 series, Precision APEX 200 series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3-2014 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide rim devices with a dual cylinder or inside thumb turn cylinder option with a visual security indicator that identifies the trims locked/unlocked status of the door from the inside of the room. Indicator in unlocked state presents a 1/2 inch x 1/2 inch white metal flag with black icon at top of device head. Indicator in locked state has no flag present. Provide rim devices without the dual cylinder or inside thumb turn cylinder option capable of being retrofitted with the visual security indicator.
6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled in the hardware sets.

2.6 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Sargent 3500, ABH PT200/PT1000

B. Requirements:

1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply , and UL class 2 listed.
4. Options:
 - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
 - b. Provide sealed batteries for battery back-up at each power supply where specified.
 - c. Provide keyed power supply cabinet.
5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

2.7 KEYING AND CYLINDERS

- ### **A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.**

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer, as directed by the owner.

2.8 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: Sargent 281/281-P10 series, Corbin DC8200/DC8210 series, Stanley Commercial Hardware QDC 100 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.

2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.10 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.

2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.11 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.12 FINISHES

A. Finish: BHMA 628 (US28) Satin Aluminum; except:

1. Hinges at Exterior Doors: BHMA 622 (US19)
2. Continuous Hinges: BHMA 622 (US19)
3. Push Plates, Pulls, and Push Bars: BHMA 622 (US19)
4. Protection Plates: BHMA 628 (US28)
5. Overhead Stops and Holders: BHMA 622 (US19)
6. Door Closers: Powder Coat to Match door
7. Wall Stops: BHMA 622 (US19)
8. Latch Protectors: BHMA 622 (US19)
9. Weatherstripping: Black Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

3.4 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.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. **The hardware groups represent 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 correction 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.**
- C. Hardware Group:

HARDWARE GROUP # 01
FOR USE ON DOOR #(S):

101
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	224HD	IVE
1	EA	PANIC HARDWARE	CD-QM-98-L-NL-06	VON
1	EA	MORTISE CYLINDER	1E74 IC MORTISE CYLINDER	BEST
1	EA	RIM CYLINDER	1E72 IC RIM CYLINDER	BEST
2	EA	PERMANENT CORE		
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH	LCN
1	EA	WEATHER RING	8310-801	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	GASKETING	328AA	ZER
1	EA	DOOR SWEEP	39A	ZER
1	EA	THRESHOLD	625A-MSLA-10	ZER

HARDWARE SET # 02
FOR USE ON DOOR #(S):

100
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	224HD EPT	IVE
1	EA	CONT. HINGE	224HD	IVE
1	EA	REMOVEABLE MULLION	KR4954 STAB	VON
1	EA	POWER TRANSFER	EPT10 CON	BEST
1	EA	ELEC RIM STRIKE	BES-0162	BEST
1	EA	ELEC LEVER	W SERIES	BEST
1	EA	ELEC PANIC HARDWARE	CD-QEL-99-L-NL-06-CON	VON
1	EA	PANIC HARDWARE	CD-QM-99-L-DT-06	VON
1	EA	MORTISE CYLINDER	1E74 IC MORTISE CYLINDER	BEST
1	EA	RIM CYLINDER	1E72 IC RIM CYLINDER	BEST
4	EA	PERMANENT CORE	KEY INTO EXISTING SYSTEM	
2	EA	SURFACE CLOSER	4040XP EDA	LCN
1	EA	TOUCHLESS AUTO OPERATOR	HEW-2	ESSEX
1	EA	WEATHER RING	8310-801	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T	LCN
1	EA	SURFACE MOUNT BOX	8310-867S	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	GASKETING	188S-BK	ZER
2	EA	DOOR SWEEP	39A	ZER
1	EA	THRESHOLD	625A-MSLA-10	ZER
1	EA	POWER SUPPLY	PS902 900-4R	VON

*DOOR CONTROLLED ELECTRONICALLY BY TIMECLOCK – SEE ELECTRICAL.

*TIMECLOCK SHALL DICTATE WHEN DOOR IS LOCKED AND UNLOCKED.

*WHEN DOOR IS UNLOCKED VIA TIMECLOCK, DEPRESSING EXTERIOR WALL MOUNT ACTUATOR SHALL OPEN DOOR AUTOMATICALLY. WHEN DOOR IS LOCKED VIA TIMECLOCK, ACTUATOR SHALL BE DISENGAGED,

*TOUCHLESS MOTION SENSOR ON NORTH DOOR LEAF EGRESS SIDE. UPON SENSING, ACTUATOR WILL RETRACT LATCHES AND OPEN DOOR AUTOMATICALLY.

HARDWARE SET # 03
FOR USE ON DOOR #(S):

102 103
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	IVE
1	EA	PUSH PLATE	8200 4" X 16"	IVE
1	EA	PULL PLATE	8305 10" 4" X 16"	IVE
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH OR PA AS REQ	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
1	EA	STEP-N-PULL FOOT DOOR OPENER	HANDS FREE DOOR OPENER	STEP-N-PULL
3	EA	SILENCER	SR64	IVE

HARDWARE SET # 04
FOR USE ON DOOR #(S):

104
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	IVE
1	EA	STOREROOM LOCKSET	9K3 7-D STOREROOM	BEST
1	EA	OH STOP	90S	GLY
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
3	EA	SILENCER	SR64	IVE

HARDWARE SET # 05
FOR USE ON DOOR #(S):

105 106
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CONT HINGE	224HD	IVE
1	EA	REMOVEABLE MULLION	KR4954 STAB	VON
1	EA	PANIC HARDWARE	CD-QM-98-L-NL-06	VON
1	EA	PANIC HARDWARE	CD-QM-98-L-DT-06	VON
2	EA	MORTISE CYLINDER	1E74 IC MORTISE CYLINDER	BEST
2	EA	RIM CYLINDER	1E72 IC RIM CYLINDER	BEST
2	EA	OH STOP	90S	GLY
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	IVE
6	EA	SILENCER	SR64	IVE

END OF SECTION 087100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

- 1. Insulated glazing unit at exterior locations.

1.2 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: 4-inch x 6-inch square, for glazing illustrating background and design element contrast.
- C. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.3 DEFINITIONS

- A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of

sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As indicated on drawings.
 - b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 3 seconds.
 - d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- wide interspace.
 3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 QUALITY ASSURANCE

- A. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 NFPA 257.

- B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS

- A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 3. Sealing System: Dual seal.
 4. Spacer Specifications: Manufacturer's standard spacer material and construction.

5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with mill or clear anodic finish.
 - b. Corner Construction: Manufacturer's standard corner construction.

2.2 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- B. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.3 GLAZING TAPES

- A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.5 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.6 INSULATING-GLASS UNITS (GL-1) – EXTERIOR GLAZING

- A. Passive Solar Low-E Insulating-Glass Units:
 - 1. Basis of Design: Vitro Solarban 60 (2) Starphire + Starphire, Glass Insulating Glass Unit.
 - 2. Other acceptable manufacturers:
 - a. Oldcastle Building Envelope.
 - b. Guardian Glass.
 - 3. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
 - 4. Interspace Content: Argon.
 - 5. Glazing: Kind FT (fully tempered) below 7'-0".
 - 6. Low-E Coating: Pyrolytic or sputtered on second surface.
 - 7. VLT: 74%.
 - 8. Exterior Reflectance: 11%.
 - 9. Interior Reflectance: 12%.
 - 10. Solar Heat Gain Coefficient: 0.41.
 - 11. Light-to-solar gain (LSG): 1.80.
 - 12. Winter Nighttime U-Factor: 0.24 maximum.

PART 3 - EXECUTION

3.1 GLAZING

- A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
 - 1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
 - 2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
 - 3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
 5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
 6. Provide spacers for glass lites where length plus width is larger than 50 inches.
 7. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
 2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 3. Apply heel bead of elastomeric sealant.
 4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 5. Apply cap bead of elastomeric sealant over exposed edge of tape.
- C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
 2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
 3. Install gaskets so they protrude past face of glazing stops.
- D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
 2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.2 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating

substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.
- B. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.

2.2 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- C. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.
- B. Related work
 - 1. Specified elsewhere
 - a. Non-Structural Metal Framing specified in Section 092216.
 - b. Painting Section 099123.

1.2 SUBMITTALS

- A. Product Data/Samples
 - 1. Submit for Engineer/Architect's approval:
 - a. Manufacturer's data and/or catalog sheets clearly indicating products proposed for use.
 - b. Manufacturer's recommended installation instructions for each specific installation.

1.3 QUALITY ASSURANCE

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- B. Contractor shall employ only skilled and experienced workmen/workwomen who are fully qualified in the installation of specified materials and shall provide a fully qualified superintendent or foreman who shall be present at all times during execution of this work.
- C. Application and Finishing Standards:
 - 1. Gypsum Association File 216.
 - 2. ASTM C840.

1.4 DELIVERY, STORAGE, HANDLING

- A. All materials shall be delivered in their original unopened packages, properly labeled; stored and handled at job site in a manner to prevent damage in accordance with manufacturer's recommendations.
 - 1. Damaged or deteriorated materials shall not be used in the construction and shall be removed from the job site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide in longest lengths practicable as will result in a minimum of joints.
- B. Provide recessed or tapered edge type for single layer application and for face layer of double layer application. Use square edge type for back-up layer of double layer application.
 - 1. Provide in thickness indicated on the drawings.
- C. General: Interior gypsum board complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. National Gypsum Company
 - 2. USG Corp.
 - 3. CertainTeed Corp.
 - 4. Georgia-Pacific Gypsum LLC

2.3 STANDARD GYPSUM BOARD

- A. Basis-of-Design: National Gypsum Gold Bond Brand Gypsum Board
 - 1. Panel Physical Characteristics
 - a. Core: Regular gypsum core
 - b. Surface Paper: 100 percent recycled content paper on front, back and long edges
 - c. Long Edges: Tapered
 - d. Overall thickness: As shown on drawings
 - e. Panel complies with requirements of ASTM C 1396

2.4 MOISTURE RESISTANT XP TYPE GYPSUM BOARD

- A. Basis-of-Design: National Gypsum Gold Bond Brand XP Gypsum Board
 - 1. Panel Physical Characteristics
 - a. Core: Mold and moisture resistant gypsum core
 - b. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back, and long edges Long Edges: Tapered
 - c. Overall thickness: As shown on drawings
 - d. Panel complies with requirements of ASTM C 1396
 - e. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Formed from zinc-coated steel not lighter than 26 ga., comply with Fed Spec. QQ-S-775, Type I, Class D or E, as approved by the Engineer/Architect.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape
 - 1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION AND WORKMANSHIP

- A. Comply with all pertinent recommendations of the applicable standards and manufacturer's installation recommendations for each specific type application.
- B. Installation of all materials shall be fully qualified, experienced workmen/workwomen, skilled in application of gypsum wallboard to metal framed and/or wood framed structures and skilled in the application and finishing of joint treatment specified.
- C. Panels shall be secured to framing members with screws of proper type and size spaced maximum of 10" o.c.; or by a combination of screw attachment and adhesive as may be recommended by the manufacturer and approved by the Engineer/Architect.
- D. Wallboard for ceiling shall be installed first and shall be installed in longest lengths practicable with long dimension perpendicular to framing members and with joints staggered a minimum of two framing spaces between adjacent panel rows.
 - 1. Where cross furring is indicated on the drawings, install wallboard with long dimension perpendicular to furring.
 - 2. For double layer application, reverse direction between layers.
- E. At junction of wallboard partitions with other type materials, provide continuous full height length acoustical sealant bead between wallboard edge trim and adjacent material.
- F. Neatly cut and fit wallboard to all electrical boxes and other penetrations through wallboard and provide compound filter and/or sealant bead around same to form an effective seal between wallboard surface and finishing plates.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments, except floors. Provide 1/4" wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on drawings, and according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.

2. Bullnose Bead: Use where indicated on drawings.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape. Tape and seal all joints and internal corners with reinforcing tape and joint compound. Apply tape and compound in strict accordance with manufacturer's directions and recommendations of the applicable standards.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 4. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 5. All taped and filled joints, filled depressions at screws, filled corner beads, and areas around electrical outlet boxes and other wall penetrations shall be expertly feathered out onto panel faces and sanded perfectly smooth, fully acceptable for final painting or other finish.
 - a. Careful attention shall be given to all internal corners and areas around electrical outlet boxes.
 - b. Joints shall be feathered out a minimum of 12" and further as necessary to render joints undetectable under finish painted surfaces.
- E. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- F. Remove and replace panels that are wet, moisture damages, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 095123 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes FRP ceiling panel and FRP suspension system for ceilings.

1.2 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics:
 - 1. Surface-Burning Characteristics: Ceiling tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.
 - a. Smoke-Developed Index: 450 or less.

1.3 SUBMITTALS

- A. Product data: for each product indicated.
- B. Samples: For each exposed finish.
- C. Maintenance data.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Ceiling Units: Full-size tiles equal to five percent of quantity installed.
 - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to five percent of quantity installed.

PART 2 - PRODUCTS

2.1 TILE CEILINGS, GENERAL

- A. Suspension System Standard: Comply with ASTM C 635.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with IBC design requirements.
- C. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 FIBERGLASS SUSPENSION SYSTEM

- A. Exposed grid suspension systems for interior ceilings with all standard components, main runners, cross tees, wall mouldings, splice plates, hanger wire, anchors, and other necessary accessories for 24" x 24" ceiling tile layouts (refer to reflected ceiling plan and/or room finish schedule of drawings). System shall conform to requirements of ASTM C635, Intermediate Duty.
1. Main Beams and Cross Tees: 1 ½" height, 1 ½" face dimension.
 2. Wall moulding: Angle type, 1.05" x 1.05"
 3. Color: white.
 4. Hanger wire: Minimum No.12 galvanized.
 5. Hold-down clips throughout
 6. Crane Composites "Sanigrid II", or Engineer/Architect approved equal.

2.3 LAY-IN FRP CEILING PANEL (FRP)

- A. Ceiling Panel
1. Crane Composites "Fire-X Glasbord – FXE"; or Engineer/Architect approved equal.
 2. Fire Class A, FM approved.
 3. Texture: Embossed.
 4. Color: White.
 5. Size: 24" x 24".
 6. Thickness: 0.09"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.
- C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices.

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.

- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095123

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 096450 – RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Supply and installation of the indoor resilient multipurpose surfacing.
- B. Application of the game lines
- C. References for the correct construction and preparation of concrete slabs to receive resilient flooring.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's promotional brochures, specifications and installation instructions
- B. Samples:
 - 1. Submit for selection and approval three (3) sets of the indoor resilient multipurpose surfacing, manufacturer's brochures, samples or sample boards of all of the available colors, textures and styles.
 - 2. Submit copy of installation warranties.

1.3 QUALITY ASSURANCE

- A. Qualifications
 - 1. The indoor resilient multipurpose surfacing shall have been actively marketed for a minimum of five (5) years.
 - 2. The indoor resilient multipurpose surfacing shall be manufactured in an ISO 9001 certified plant.
 - 3. The indoor resilient multipurpose surfacing supplier shall be an established firm experienced in the field and appointed as a distributor by the manufacturer of the indoor resilient multipurpose surfacing.
 - 4. The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years experience in the field installing indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size, type and complexity.
- B. Certifications:
 - 1. Installer to submit the indoor resilient athletic surfacing manufacturer's or distributor's certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.
- C. Testing:

1. Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM and/or EN standard testing procedures.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Store the material in a secure, clean and dry location. Maintain temperature between 55° and 85° Fahrenheit. Store the indoor resilient athletic surfacing on a clean flat surface. Do not stack rolls.

1.5 PROJECT SITE / CONDITIONS

- A. It is the responsibility of the general contractor/construction manager to maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.
- B. The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.
- C. All other trades shall have completed their work prior to the installation of the resilient athletic flooring. The general contractor or Construction Manager shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.
- D. Maintain a stable room temperature of at least 65°F for a minimum of one (1) week prior to, during and thereafter installation.
- E. An effective low-permeance vapor barrier is placed directly beneath the concrete subfloor. For "on" or "below grade" installations, it is recommended to provide a permanent vapor barrier resistant to long term hydrostatic pressure/moisture exposure. Protrusions should be sealed to prevent moisture migration into the slab. Moisture should not be allowed to enter the slab after the completed construction.
- F. Concrete subfloor surface pH level within the 7 to 9 range dependent upon installation type.
- G. Concrete subfloor should be no greater than 1/8" within a 10 ft diameter. This tolerance can be measured in accordance with ASTM E1155.
 1. A specified (F_F) of 50 and an (F_L) of 30 should reach this degree of floor flatness and floor level. There is no numerical correlation between F numbers and the deviation from the straight edge, however the above specified numbers should achieve a flat floor with minimal deviation in the slab. Reference ACI 117 and ACI 302.1R. The general contractor should provide a certificate of compliance with the above recommendations.
- H. Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.
- I. Fill cracks, grooves, voids, depressions, and other minor imperfections with Ardex (or equal) cement-based patching/leveling compounds. Follow the manufacturer's directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the

architect's recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.

- J. Refer to ACI 302.2R "Guidelines for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" for concrete design and construction.
- K. Concrete slab shall be fortified with continual steel reinforcement. Fiber reinforcement alone shall not be considered adequate fortification.

1.6 WARRANTY

- A. Materials: The indoor resilient athletic surfacing shall be covered by the manufacturer against product defects for 3 years.
- B. Installation: The installation of the indoor resilient multipurpose surfacing shall be covered against poor workmanship and faulty installation by a two (2) year written, limited warranty provided by the contractor performing/overseeing the installation.

1.7 ADDITIONAL MATERIALS

- A. Furnish to the owner additional materials containing a total of at least 5% of each different color or design of the indoor resilient athletic surfacing used on the project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The basis of the design for the indoor resilient multipurpose surfacing is **Dropzone Speckle** as provided by FieldTurf USA, Inc
- B. Other acceptable manufacturers
 - 1. Tarkett.
 - 2. Musson Rubber Co.

2.2 MATERIALS

- A. Dropzone Speckle 8mm recycled non-laminated rubber flooring.
 - 1. Physical properties of the indoor resilient athletic surfacing shall conform to the following minimums:

Width	Tile 2ft x 2ft
Total Thickness	8 mm
Weight	1.92 lbs/sq.ft.
Tensile Strength	ASTM D412	200 minimum
Static Load	ASTM F970	1000 p.s.i (modified test)

Coefficient of Friction	ASTM 2047	>.9
Chemical Resistance	ASTM F925	Excellent
Ambient Noise Reduction	ASTM C423	.10
Impact Sound Insulation	ASTM E492	.45 minimum
Thermal Conductivity	ASTM C518	Approximate .406
Sound Transmission	ASTM 413	.45 minimum

2. Color: DZ02-Grey.
3. Adhesive: As approved by the indoor resilient athletic surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. It is the responsibility of the general contractor/construction manager to ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.
- B. Verify that the area in which the indoor resilient athletic surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.
- C. Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient athletic flooring installation is completed or suspended.
- D. Verify that there is a stable room temperature of at least 65°F.
- E. Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.
- F. Direct Full Spread Adhering to Concrete Subfloor : moisture content less than 98 % RH when tested per ASTM F2170. Use only manufacturer recommended Multi-Poxy adhesive.
- G. If both tests are performed, use the highest value. Do not average the results of the tests. Report all field test results in writing to the General Contractor, Architect, and End User prior to installation.
- H. Verify that the concrete subfloor surface pH level is within the 7 - 9 range.
- I. Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

3.2 PREPARATION OF SURFACES

- A. Sand the entire surface of the concrete slab.
- B. Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.

- C. Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.3 INSTALLATION

- A. The installation area shall be closed to all traffic and activity for a period to be set by the indoor resilient athletic surfacing installer. The indoor resilient athletic surfacing installation shall not begin until the installer is familiar with the existing conditions.
- B. All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials and any other items that may inconvenience others.
- C. Install the indoor resilient athletic surfacing in strict accordance with the indoor resilient athletic surfacing manufacturer's written instructions.
- D. Install the indoor resilient athletic surfacing minimizing cross seams. Provide a seam diagram during the submittal process for approval prior to installation.
- E. Install appropriate threshold plates or transition strips where necessary

3.4 CLEANING

- A. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient athletic surfacing in accordance with the manufacturer's instructions.

3.5 PROTECTION

- A. If required, protect the indoor resilient athletic surfacing from damage using coverings approved by the manufacturer until acceptance of work by the customer or their authorized representative.

3.6 RELATED STANDARDS AND GUIDELINE

- A. ASTM F2170 "Standard Test Method for Determining Relative Humidity In Concrete Floor Slabs Using In-Situ Probes"
- B. ASTM F710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring"
- C. ACI 302.2R-06 "Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials"

END OF SECTION 096450

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 096519 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Includes:
 - a. Resilient Rubber Base
- B. Pre-Installation Conference
 - 1. Pre-installation conference with architect required one week before commencing work for all floor patterns.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for Architect's approval (minimum of 2 copies required)
 - a. Layout drawings indicating all areas receiving resilient flooring and/or base.
- B. Product Data/Samples
 - 1. Prior to ordering materials, submit for Architect's verification, samples of each color and pattern of floor covering required.

1.3 QUALITY ASSURANCE

- A. Contractor shall employ only skilled and experienced installers who are fully qualified in the installation of specified materials and shall provide a fully qualified superintendent or foreman who shall be present at all times during execution of this work.
- B. In order to establish minimum quality requirements, products of certain manufacturers are listed. Products of other reputable manufacturers, which are equal in all respects to those listed, will be considered, subject to Architect's approval.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be delivered in their original unopened packages, properly labeled; stored and handled at job site in a manner to prevent damage or deterioration in accordance with manufacturer's recommendations.
 - 1. Damaged or deteriorated materials shall not be used in the construction work and shall be removed from the job site.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient floor during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
 - 1. Install resilient products after other finishing operations, including painting, have been completed.
 - 2. Close spaces to traffic for 72 hours after floor covering installation.

1.6 REPLACEMENT MATERIALS / EXTRA STOCK, SURPLUS MATERIAL

- A. At completion of the work, furnish and deliver to the Owner for his use in future replacement, modifications or maintenance:
 - 1. One full carton of each color or pattern of floor tile used. Make certain that tile is from same color run as the installed tile
 - 2. Not less than 50 SF of sheet vinyl flooring

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RES-1)

- A. Basis of Design Product: Johnsonite, Rubber Base
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
 - 2. Manufacturing Method: Group 1 (solid, homogeneous).
 - 3. Style: Coved.
 - 4. Minimum Thickness: 1/8 inch
 - 5. Height: 6 inches
 - 6. Lengths: Coils in manufacturer's standard length.
 - 1. Colors & Patterns: As indicated on drawings and schedules. Provide either the named product or a comparable product by one of the other manufacturer's specified.
 - a. Burke
 - b. Roppe

2.2 RESILIENT MOLDING ACCESSORIES

- 1. Description: Carpet edge for glue-down applications, reducer strip for resilient floor covering, joiner for tile and carpet, joiner for tile and resinous flooring and transition strips at door openings between corridors and rooms with vinyl composition tile.
- 2. Material: Rubber or Vinyl
- 3. Color & Patterns: To be selected by architect from manufacturers full range

2.3 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L
 - b. Floor Adhesive: Not more than 60 g/L
- B. Resilient Edge Strips: Strips shall be homogeneous vinyl or rubber composition with a tapered or bull nosed edge no less than 1 inch wide, colored to match flooring or as selected by Architect from standard colors available.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS/JOB CONDITIONS

- A. General Contractor shall turn over all floor surfaces to flooring contractor in broom-clean condition. Flooring contractor shall inspect all floors prior to installation of any materials. Correct conditions detrimental to proper installation. Do not proceed with work of this section until unsatisfactory conditions have been corrected. Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the drawings. Existing vinyl tile shall remain, re-adhere any loose tile. Patch voids in existing vinyl tile as necessary with like-thickness material to provide suitable substrate for new resilient flooring. Remove all wax, etc. as necessary to insure bond for new resilient flooring.
- B. General finishing operations, including painting, should be completed and permanent heating system should be in operation prior to starting this work.
- C. Temperature of at least 70° F shall be maintained:
 - 1. In areas where flooring materials are stored during the 24-hour period immediately prior to installation.
 - 2. In areas where resilient flooring is to be installed, during installation, and for 48 hours thereafter.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete curing agents, sealers or hardeners should be removed.
- C. Depressions in concrete floors shall be primed with emulsified asphalt thinned to a brushing consistency and filled with a mixture of 1-part high early strength cement, 2-parts sand, and 1-part emulsified asphalt tempered with water to a plastic mortar as dry as can be placed. Allow filler to thoroughly cure and harden before flooring is installed.

- D. Depressions in concrete floors shall be primed with emulsified asphalt thinned to a brushing consistency and filled with a mixture of 1-part high early strength cement, 2-parts sand, and 1-part emulsified asphalt tempered with water to a plastic mortar as dry as can be placed. Allow filler to thoroughly cure and harden before flooring is installed

3.3 INSTALLATION

A. General

- 1. Verify that moisture content of concrete slabs, building air temperature, and relative humidity are within limits recommended by manufacturers of materials to be used.
- 2. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on the finish surface as marked on the subfloor. Use chalk or other non-permanent marking device.
- 3. Apply approved adhesives in strict accordance with the manufacturer's recommendations and install flooring only when adhesive has reached correct consistency.
- 4. Butt flooring tightly to vertical surfaces, nosings, edgings, thresholds, etc.
- 5. Expertly scribe around pipes and other obstructions to produce neat appearance.
- 6. Extend flooring into toe spaces, door reveals, and similar spaces.
- 7. Install tapered reducer strips at all exposed edges of resilient flooring.
- 8. Roll flooring with minimum 100 lb. roller. Provide smooth finished floor installation, free of buckles, cracks, waves, or unsightly joints.

B. Installing Vinyl Composition Tile

- 1. Install using tile from a number of open cartons to prevent noticeable color change lines.
- 2. Install all tile in straight line pattern unless specifically indicated otherwise on drawings.
- 3. Install all tile with pattern design.
- 4. Tile shall be installed symmetrical about center lines of rooms or areas\generally but layout shall be carefully considered and modified as necessary to eliminate small or thin pieces at walls, for best overall appearance.
- 5. Install divider strips under doors as necessary between rooms or areas for off-setting pattern lines.
- 6. Refer to Floor Pattern Plan on Drawings. Verify with Engineer/Architect, layout of floor tile pattern and use of divider strips.

C. Resilient Accessory Installation

- 1. Comply with manufacturer's written instructions for installing resilient accessories.
- 2. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed

3.4 ADJUSTMENTS AND PROTECTION

- A. At conclusion of the work, examine entire installation. Replace all damaged tile and leave entire installation free from defects.
- B. Remove all excess adhesive from face of flooring. Thoroughly clean and remove all

- marks, mastic spots, etc. from floors and other surfaces.
- C. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- D. Cover resilient products until Substantial Completion

END OF SECTION 096519

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 096723 - RESINOUS FLOORING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Resinous flooring system as shown on the drawings and in schedules.
- B. Related sections include the following:
 - 1. Cast-in-Place Concrete, section 033000

1.2 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with colored quartz aggregate broadcast and methyl methacrylate (MMA) broadcast and topcoats.
- B. The system shall have the color and texture as specified with a nominal thickness of 1/4 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- C. Cove base to be applied where noted on plans and per manufacturers standard details unless otherwise noted

1.3 SUBMITTALS

- A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
- B. Manufacturer's Material Safety Data Sheet (MSDS) for each product being used.
- C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

1.4 QUALITY ASSURANCE

- A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
- B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- C. No requests for substitutions shall be considered that would change the generic type of the specified System.
- D. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to

review clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.6 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with cementitious urethane material.

1. Concrete shall be moisture cured for a minimum of 3 days and have fully cured a minimum of 5 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
3. Sealers and curing agents should not to be used.
4. Concrete shall have a minimum design strength of 3.500 psi. and a maximum water/cement ratio of 0.45
5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. Non-related personnel in the work area shall be kept to a minimum.

1.7 WARRANTY

- A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
- B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 – PRODUCTS

2.1 FLOORING

- A. Dur-A-Flex, Inc, Hybri-Flex MQ (self leveling broadcast colored quartz), MMA topcoat seamless flooring system.
 1. System Materials:
 - a. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and SL aggregate.
 - b. The aggregate shall be Dur-A-Flex, Inc. Q28-23 colored quartz aggregate.
 - c. Broadcast: Dur-A-Flex, Inc. Cryl-A-Glaze G-201, MMA based two-component resin.
 - d. Topcoats: Dur-A-Flex, Inc. Cryl-A-Top T-301, MMA-based, two-component resin.
 2. Patch Materials
 - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).
 - b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Poly-Crete WR.

2.2 MANUFACTURER

- A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, David Haddon, Phone: (312) 339-2191, Email: Daveh@dur-a-flex.com.
- B. Other acceptable manufacturers:
 - a. Crossfield Products Corp., Dex-O-Tex.
 - b. Stonhard, Inc.
 - c. Silikal Resin Systems.
 - d. General Polymers Corporation.

2.3 PRODUCT REQUIREMENTS

- | | |
|--|---------------------------|
| A. Topping | Poly-Crete SL |
| 1. Percent Reactive | 100 % |
| 2. VOC | 0 g/L |
| 3. Bond Strength to Concrete ASTM D 4541 | 400 psi, substrates fails |
| 4. Compressive Strength, ASTM C 579 | 9,000 psi |

- | | |
|--|--------------|
| 5. Tensile Strength, ASTM D 638 | 2,175 psi |
| 6. Flexural Strength, ASTM D 790 | 5,076 psi |
| 7. Impact Resistance @ 125 mils, MIL D-3134, | 160 inch lbs |
| No visible damage or deterioration | |

B. Broadcast Coat

Cryl-A-Glaze G-201

- | | |
|--|-------------------------|
| 1. Percent Reactive, | 100 % |
| 2. VOC | <100 g/L |
| 3. Water Absorption, ASTM D 570 | 0.04 % |
| 4. Tensile Strength, ASTM D 638 | 2,175 psi |
| 5. Coefficient of thermal expansion
ASTM D 696, | 0.000035 in/in/F |
| 6. Electrical Resistivity, ASTM D 257 | |
| Volume resistance. | 10 ¹⁵ ohm-cm |
| Surface resistance, | 10 ¹² ohm |
| 7. Pot Life @ 68 F | 10-20 minutes |
| 8. Cure Time @ 68 F | 40-60 minutes |
| 9. Recoat Time @ 68 F | 60 minutes |
| 10. Multi-coat Application, solution weld | yes |

C. Topcoat

Cryl-A-Top T-301

- | | |
|---|--------------------------------------|
| 1. Percent reactive resin | 100 % |
| 2. VOC | <100 g/L |
| 3. Water absorption ASTM D 570 | 0.4 % |
| 4. Tensile strength, ASTM D 638 | 3,550 psi |
| 5. Tensile modulus, ASTM D 638 | 300,000 psi |
| 6. Coefficient of thermal expansion
ASTM D 638 | 0.000035 in/in/F |
| 7. Electrical resistance ASTM D 257 | |
| Volume resistance | 10 ¹⁵ ohm-cm |
| Surface resistance | 10 ¹² ohm |
| 8. Water vapor transmission
DIN 53122 | 0.9 g/cm-hr-mm HG x 10 ⁻⁹ |
| 9. Potlife @ 68 F | 10-15 minutes |
| 10. Cure time @ 68 F | 30-45 minutes |
| 11. Recoat time @ 68 F | 30-45 minutes |
| 12. Multi-coat application, solution weld | yes |

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
 - a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.
 - b. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
 - c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
3. Mechanical surface preparation
 - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
 - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
 - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

A. General

1. The system shall be applied in five distinct steps as listed below:
 - a. Substrate preparation
 - b. Topping/overlay application with quartz aggregate broadcast.
 - c. Resin application with quartz aggregate broadcast.
 - d. Topcoat application
 - e. Second topcoat application.
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the

Applicator.

B. Topping

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using ½ inch “v” notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 80 sf/gal for Q28.
2. The broadcast coat shall be comprised of a liquid component and a hardener powder which is added at the rate in accordance with the Manufacturers recommendations and thoroughly dispersed by mechanical means such as a high speed paddle mixer.
3. Colored quartz aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs/sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Topcoat

1. The first topcoat shall be roller applied with a coverage rate of 80 sf/gal. for Q28.
2. The topcoat shall be comprised of a liquid component and a hardener powder which is to be added at a rate in accordance with the Manufacturer's recommendations and thoroughly dispersed by suitably approved mechanical means such as a high speed paddle mixer.
3. The first topcoat will be allowed to cure then can be sanded or scraped to give desired finish texture
4. The second topcoat shall be roller applied with a coverage rate of 100 sf/gal.
5. The finish floor will have a nominal thickness of 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
 - a. Temperature
 1. Air, substrate temperatures and, if applicable, dew point.
 - b. Coverage Rates

1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.5 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 096723

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces as indicated on finish plans and elevations, unless fully factory-finished.
- 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 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- E. SSPC-SP 2 - Hand Tool Cleaning 2018.
- F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.3 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.
 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 product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.
- 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.

1.4 QUALITY ASSURANCE

- A. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
- B. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

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 (7 degrees C) and a maximum of 90 degrees F (32 degrees C), 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 (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors 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

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 2. PPG Paints: www.ppgpaints.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

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.
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State in which the Project is located.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Colors: As indicated on drawings.

2.3 PAINT SYSTEMS - INTERIOR

- A. PNT-0 Waterborne Dry Fall over Quick Dry Alkyd Primer – Exposed Ceilings and exposed items in ceiling: MPI 5.1C
 - 1. Prime Coat: Alkyd Quick Dry Metal Primer: MPI #76.
 - a. Products:
 - 1) Sherwin Williams, Kem Bond HS Universal Metal Primer, B50 Series.
 - 2. Top Coat: Dry Fall, Latex, eggshell (MPI Gloss Level 3), MPI #155.
 - a. Products:
 - 1) Sherwin Williams, Pro Industrial Waterborne Acrylic Dryfall, Eg-Shel, B42 Series.
- B. PNT-1 Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)
 - 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- C. PNT-2 Interior Wet Wall Surfaces to be Painted, as indicated:
 - 1. Two top coats and one coat latex primer.
 - 2. Top Coat(s): Interior Epoxy
 - a. Products:
 - 1) Sherwin-Williams Water based catalyzed epoxy.
 - 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- D. PNT-3 Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include doors and door frames.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153 or 154.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)
 - 4. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 - 5. Primer: As recommended by top coat manufacturer for specific substrate.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Interior Latex Primer Sealer; MPI #50.
 - a. Products:
 - 1) Sherwin Williams ProMar 200 Zero VOC Primer.
 - 2. Interior Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin Williams Pro-Cryl Universal Acrylic Primer.

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 affect 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 is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes acceptance of substrates and conditions.

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 repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances 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. 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".
- 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 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.

END OF SECTION 099123

SECTION 102113 – SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

A. Plastic toilet compartment partitions for following applications:

- a. Toilet enclosures.
- b. Urinal screens.

B. Related Requirements:

- A. Division 03 Section "Cast in Place Concrete" for compartment anchorage to concrete substrates.

1.2 REFERENCES

A. ASTM International (ASTM):

- A. ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- B. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. ASTM A 743/A 743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
- D. ASTM B 86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
- E. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. International Code Council (ICC)/American National Standards Institute (ANSI):

- A. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities, as applicable to toilet compartments designated as accessible.

C. United States Department of Justice:

- A. ADA - Americans with Disabilities Act, Excerpt from 28 CFR Part 36 - ADA Standards for Accessible Design.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each type of product indicated. Include fabrication details, description of materials and finishes.

- A. Product Test Reports: When requested by Architect, submit documentation by qualified independent testing agency indicating compliance of products with requirements.

- B. Shop Drawings: Include overall product dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.
- C. Samples for Selection: Furnish samples of manufacturer's full range of colors for initial selection.
- D. Samples for Verification: Furnish physical sample of material in selected color.
 - A. Size: 2 by 2 inch (52 by 52 mm) minimum, in type of finish specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum [5] years experience in the manufacture of toilet compartments.
- B. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum [5] years experience in the manufacture of toilet compartments. Manufacturers seeking approval must submit the following in accordance with Instructions to Bidders and Division 01 requirements:
 - A. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
 - B. Samples of each component of product specified.
 - C. List of successful installations of similar products available for evaluation by Architect.
- C. Installers Qualifications: Experienced Installer regularly engaged in installation of toilet compartments for minimum 3 years.
- D. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.
- E. Accessibility Requirements: Comply with requirements of ICC/ANSI 117.1, and with requirements of authorities having jurisdiction.
- F. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - A. Flame-Spread Index: Not greater than 75.
 - B. Smoke-Developed Index: 450.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.
 - A. Deliver toilet compartments in manufacturer's original packaging.
 - B. Store in an upright condition.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:

- A. Plastic Toilet Partitions: Against corrosion, breakage, and delamination: 15 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Bradley Corporation, The Mills Company, Menomonee Falls, WI 53051.

- A. Other acceptable manufacturers:
 - a. General Partitions Manufacturing Corp.
 - b. Scranton Products.

2.2 MATERIALS

- A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface, Class B.

- A. Provide panels with minimum 30 percent pre-consumer recycled content.
 - B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.
 - C. Stainless Steel Sheet: ASTM A 240 or A 666, 300 series.
 - D. Stainless Steel Castings: ASTM A 743/A 743M.
 - E. Aluminum: ASTM B 221.

2.3 PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartment Type:

- A. Overhead braced.
 - a. Basis of Design Product: Bradley, Mills Partitions, Sentinel, Series 400 – No Site.
 - b. General Partitions, Series 40 – Eastern Style.
 - c. Scranton Products, Eclipse Partitions

- B. Urinal Screen Style:

- A. Wall hung with brackets:
 - a. Basis of Design Product: Bradley, Mills Partitions, Model No. 4.
 - b. General Partitions, WSH-10
 - c. Scranton Products, Eclipse Partitions, Wall-mounted

- C. Door, Panel, and Pilaster Construction, General: HDPE, with a 3/16" (4.8mm) radiused edge.
 - A. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, or other imperfections.
 - B. Provide aluminum heat sink at bottom edge of panels and doors.
 - C. Provide no-sightline system.
- D. Door Construction: 1 inch (25 mm) thick.
- E. Panel Construction: 1 inch (25 mm) thick.
- F. Pilaster Construction: 1 inch (25 mm) thick.
- G. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Clamps around pilaster and is secured to the wall with stainless steel brackets.
- H. Shoes: 4 inches (76 mm) high minimum, 300 series stainless steel with No. 4 satin brushed finish.
- I. Urinal-Screen Construction: Matching toilet compartment panel construction
- J. Brackets (Fittings):
 - A. Stirrup Type: Ear or U-brackets; aluminum.
 - B. Full-Height (Continuous) Type: Manufacturer's standard design;
- K. Plastic Panel Finish: Manufacturer's standard impregnated finish, with one color in each room.
 - A. Color: Black.

2.4 HARDWARE

- A. Hardware, Heavy Duty: Manufacturer's heavy-duty stainless steel, including stainless steel tamper-resistant fasteners:
 - A. Hinges: Self-closing integral, nylon, gravity-type adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door.
 - B. Latch and Keeper: Surface-mounted slide latch with flat rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.
 - C. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors. Mount with stainless steel through-bolts.
 - D. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.

2.5 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging

doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.
- A. Proceed with installation once conditions meet manufacturer's requirements.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Install toilet partitions and screens in spaces with operating, temperature controlled HVAC systems. Shield partitions and screens from direct sunlight.
- C. Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 1/2 inch (13 mm) between pilasters and panels, and 1 inch (25 mm) between panels and walls.
- D. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 15 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.4 FINAL CLEANING

- A. Remove packaging and construction debris and legally dispose of off-site.
- B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION 102113

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Corner guards.
2. End wall guards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include sections, details, and attachments to other work.
- C. Samples: For each type of unit and for each color and texture required.
- D. Maintenance data.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70°F.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Manufacturer's Limited Lifetime Warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Extruded Rigid Plastic: High-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout.
- B. Rigid Vinyl Sheet: Shall be manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive metal; security-type where exposed to view.

2.2 CORNER GUARDS (CG-1)

- A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: InPro Door and Wall Protection Systems; Division of InPro Corporation, Model 150 Surface Mount Corner Guard or a comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Korogard Wall Protection Systems; Division of RJF International Corporation.
 2. Cover: Extruded rigid plastic, minimum .080" wall thickness; as follows:
 - a. Profile: Nominal 3" wings.
 - b. Height: 8 feet.
 - c. Color and Texture: As indicated on drawings and schedules.
 3. Retainer: Minimum 0.070 (1.8 mm) thick, 1-piece, extruded aluminum.
 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 END WALL GUARD (EW-1)

- A. End Wall Protection System:
1. Basis-of-Design Product: InPro Door and Wall Protection System; Division of InPro Corporation, Model 150 End Wall Protector System or a comparable product by one of the following:
 - a. Construction Specialties, Inc
 - b. Koroguard Wall Protection Systems; Division of RJF International Corporation.
 2. Cover: Extruded rigid plastic, minimum .080" wall thickness; as follows:
 - a. Size: 3" x 3" vinyl cover.
 - b. Length: 8' long.
 - c. Color: As indicated on drawings and schedules.
 3. Retainer: Minimum 0.070 (1.8 mm) thick, 1-piece, extruded aluminum.
 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.
- B. Wall surface shall be dry and free from dirt, grease, and loose paint.

3.2 PREPARATION

- A. Prior to installation, clean substrate to remove dust, debris and loose particles.

3.3 INSTALLATION

- A. Install impact-resistant wall-protection units 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.
 - 1. Corner Guards: Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - 2. End Wall Protector: Install according to manufacturer's recommendations and instructions.
 - 3. Trim top of corner guards and end wall protectors as needed at the ceiling.
- B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 102800 - TOILET AND SHOWER ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Toilet Accessories.
 - 2. Shower Accessories.
 - 3. Under Lavatory Guards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule:
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 TOILET AND SHOWER ACCESSORIES

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation.
 - 3. American Specialties, Inc.
- B. Mirror Unit (MIR-1):
 - 1. Basis-of-Design Product: Bobrick "B-165 Series".
 - a. Bradley "Model 781".
 - b. American Specialties "0620 Series".
 - 2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
 - 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - 4. Size: As indicated on Drawings.
- C. Soap Dispenser (SOAP-1):
 - 1. Basis-of Design Product: Bobrick "B-4112 Series"
 - a. Bradley "Model 6542"
 - b. American Specialties "Model 0345"
 - 2. Description: Surface-mounted liquid soap dispenser
 - 3. Mounting: Surface mounted
 - 4. Operation: Valve-operated manual dispenser.

5. Capacity: 40-fl oz.
 6. Material and Finish: Stainless steel with satin finish.
- D. Paper Towel Dispenser (TD-1):
1. Basis-of Design Product: Bobrick "B-72974 Series"
 - a. Bradley "Model 2498"
 - b. American Specialties "Model 68523A"
 2. Description: Automatic, universal surface-mounted roll towel dispenser
 3. Mounting: Surface mounted
 4. Operation: Electronic sensor
- E. Waste Receptacle (WR-1)
1. Basis-of Design Product: Bobrick "B-43644 Series"
 - a. Bradley "Model 344"
 - b. American Specialties "Model 0458"
 2. Description: Recessed waste receptacle with all-welded construction
 3. Mounting: Recessed mounting
 4. Capacity: 12.8 gal.
 5. Material and Finish: Stainless steel construction with satin-finish
- F. Toilet Tissue (Roll) Dispenser (TPH-1):
1. Basis-of Design Product: Bobrick "B-4288 Series"
 - a. Bradley "Model 5A10"
 - b. American Specialties "Model 0030"
 2. Description: Single-roll dispenser.
 3. Mounting: Surface mounted.
 4. Operation: Noncontrol delivery with standard spindle.
 5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
 6. Material and Finish: Satin-finish aluminum bracket with plastic spindle.
- G. Sanitary Napkin Disposal (SND-1)
1. Basis-of Design Product: Bobrick "B-270 Series"
 - a. Bradley "Model 4A10"
 - b. American Specialties "Model 20852"
 2. Description: Surface-mounted sanitary napkin disposal with cover
 3. Mounting: Surface mounted
 4. Operation: Flip-up cover
 5. Material and Finish: Stainless steel construction with satin-finish
- H. Toilet Grab Bar (GRB-1):
1. Basis-of-Design Product: Bobrick "B-6806 Series".
 - a. Bradley "Model 812".
 - b. American Specialties "3800 Series".
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish.
 4. Outside Diameter: 1-1/2 inches.
 5. Configuration and Length: As indicated on Drawings.
- I. Shower Grab Bar (GRB-2):
1. Basis-of-Design Product: Bobrick "B-6861 Series".
 - a. Bradley "Model 812".
 - b. American Specialties "3860 Series".
 2. Description: Two-wall horizontal grab bar

3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish.
5. Outside Diameter: 1-1/2 inches.
6. Configuration and Length: As indicated on Drawings.

J. Shower Grab Bar (GRB-3):

1. Basis-of-Design Product: Bobrick "B-6806 Series".
 - a. Bradley "Model 812".
 - b. American Specialties "3800 Series".
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

K. Fold-up Shower Seat (SEAT-1):

1. Basis-of-Design Product: Bobrick "B-5181 Series".
 - a. Bradley "Model 9569"
 - b. American Specialties "Model 8206"
2. Description: L-shaped seat designed for wheelchair access.
3. Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting mechanism: Stainless steel, No. 4 finish (satin)

L. Robe Hook (RH-1):

1. Basis-of-Design Product: Bobrick "B-76717 Series"
 - a. Bradley "Model 9114"
 - b. American Specialties "Model 7340-S"
2. Description: Surface-mounted single robe hook
3. Material and Finish: Stainless Steel, No. 4 Finish (Satin).

2.2 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

END OF SECTION 102800

SECTION 104414 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes
 - 1. Provide complete, in place, the fire extinguishers and cabinets for the project, as shown, noted, or scheduled on the drawings and as specified herein.
 - a. Refer to drawings for locations and for details of wall construction and conditions.

1.2 SUBMITTALS

- A. Product Data/Samples
 - 1. Submit for Engineer/Architect's approval: (1 copy required)
 - a. Manufacturer's catalog or data sheets on specified fire extinguishers and cabinets together with manufacturer's recommended installation instructions.

1.3 QUALITY ASSURANCE

- A. Contractor shall employ only skilled and experienced workmen/workwomen who are fully qualified and familiar with the recommended installation procedures for the specified products and the wall construction involved.

PART 2 - PRODUCTS

2.1 EXTINGUISHERS AND CABINETS

- A. Marked "FEC-FR" on Drawings:
 - 1. Multi-Purpose Dry Chemical Extinguisher, heavy duty steel cylinder, class A B & C fires, 5 lb. capacity, rated 4A-60BC. Provide with cabinet of cold rolled steel, black powder-coated finish, fully recessed mount type with 1-3/4-inch trim, steel frame, clear acrylic glass door, vertical white "Fire Extinguisher" decal, continuous hinge, recessed pull handle, roller catch, 13-7/8" x 27-3/8" x 6".
- B. Approved Products
 - 1. J. L. Industries "Cosmic 10E", "Ambassador 1015F10A".
 - 2. Larsen's Manufacturing Company "2409-R2", "MP5-A".
 - 3. Weber Fire and Safety "2409-R2", "MP5-A".
- C. Provide extinguishers fully charged, ready for service, and provide all accessories required for complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets in prepared openings in accordance with the applicable drawing details and approved submittals, and as recommended by the manufacturer.
- B. Install wall hung units using proper mounting hardware as supplied with units, for rigid installation.
- C. Mounting Heights: As detailed on the drawings, or as directed by the Engineer/Architect.

END OF SECTION 104414

SECTION 122100 - WINDOW BLINDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes
 - 1. Provide complete, in place, the window blinds for the project, as shown, noted, or scheduled on the drawings and as specified herein.

1.2 SUBMITTALS

- A. Product Data/Samples
 - a. Manufacturer's catalog or data sheets on all specified products together with manufacturer's recommended installation instructions.

1.3 QUALITY ASSURANCE

- A. A.Contractor shall employ only skilled and experienced workmen/workwomen who are fully qualified and familiar with the assembly and recommended installation procedures for specified products.

PART 2 - PRODUCTS

2.1 WINDOW BLINDS (BL-1)

- A. Manufacturers:
 - 1. Basis of design: Venetian Blind, Inc.
 - 2. Other acceptable manufacturers:
 - a. Blinds to Go; Aluminum Mini Blinds Collection; Mini II; Color: 0510 White Matte.
 - b. Blindster; 1" Aluminum Blinds; Color: Snow White.
- B. Type: Horizontal window blinds.
 - 1. Slats shall be of specially formulated aluminum alloy 6011, spring tempered by cold rolling and heat treating. Slats shall be nominally 1" wide and .006" thick, with radius corners. The finish will consist of a primer and baked enamel finish.
 - 2. Headrail shall be .025" cold rolled steel, formed into a 1" x 1" U-shaped profile with rolled edges at top. Headrail finish will consist of a primer and baked enamel finish. End locks shall be .024" electro-galvanized cold rolled steel which locks positively in ends of the headrail.
 - 3. Bottom rail shall be .018" cold rolled sheet steel, bonderized, corrosion resistant treated, with baked on finish paint applied over prime coat. It shall be formed into a closed oval

- tubular shape with a double lock seam contoured to match the slat curvature, with color coordinated thermo plastic end caps.
4. Tilt Rod shall be solid cold rolled steel with corrosion resistant finish, with maximum cross section dimension of 1/4" to fit openings in tape roll and tilter components. Tilter shall have an electro-galvanized steel housing with worm and gear of die cast metal. Operation shall be by an extruded acrylic tubular detachable wand.
 5. Braided ladders and lift cord shall be of 100% braided polyester yarn. Vertical cables .076" x .038" diameter, each spaced 1-3/16" apart by horizontal rungs. The horizontal rungs to consist of 2 criss -crossed threads, each .015" diameter, inter-braided with the vertical cables and vertically spaced at 20mm intervals to assure proper overlap of the slats. Lift cord shall be .070" diameter of 2 ply polyester cord filler and braided polyester jacket.
 6. End brackets shall be of .042" electro-galvanized steel, coated with polyester baked on finish coat to match headrail. Blinds over 60" wide or over 60 sq. ft. in area shall be provided with an intermediate support bracket to be spaced evenly along the headrail at a maximum distance between brackets of 60".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate as required with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this section, including proper wood backing in furred spaces at windows.
- B. Install each blind in its proper location, firmly anchored into position, level and plumb, and in accordance with manufacturer's recommendations and proper installation templates.

END OF SECTION 122100

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal building systems that consist of integrated sets of mutually dependent components including structural framing, roof panels, gutters, downspouts, snow bars, wall panels, wall and roof insulation liner system with thermal blocks, interior metal liner panels, and all necessary accessories.
- B. Related Work Specified Elsewhere:
 - 1. Section 033000 Cast-In-Place Concrete
 - 2. Section 081100 Metal Door Frames
 - 3. Section 084113 Aluminum Framed Entrances and Storefronts

1.2 SUBMITTALS

- A. Product Data: For each type of metal building system component indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
 - 3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - 4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
- C. Samples: For each type of building component and for each color and texture required.
- D. 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 and load combinations.
 - 9. Building-use category.

10. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
- E. Welding certificates.
- F. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.
- G. Manufacturer certificate.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Design Loads: As indicated on Drawings.
 2. Design Loads: As required by International Building Code (IBC) 2018 edition.
 3. Design Loads: Refer to mechanical plans for equipment suspended from building framing. Roof purlins and rafters shall be designed for maximum $L/240$ deflection.
- B. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- C. Thermal Performance: Provide insulated metal panel assemblies meeting the 2018 International Energy Conservation Code with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
 1. Metal Roof Panel Assemblies:
 - a. U-Factor: 0.035
 2. Metal Wall Panel Assemblies:
 - a. U-Factor: 0.052
- D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

1.4 QUALITY ASSURANCE

- A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- B. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
 1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

- D. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.
- F. Pre-Erection Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal building systems including, but not limited to, the following:
 - 1. Inspect and discuss condition of foundations and other preparatory work performed by other trades.
 - 2. Review structural load limitations.
 - 3. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.6 PROJECT CONDITIONS

- A. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.8 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: 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.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Provide manufacturer's standard 20-year weathertight warranty on galvalume roof panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Basis of design: Ceco Building Systems; Wall Panel – ShadowRib, Roof Panel – Double Lok
 - 2. VP (Varco Pruden) Buildings; Wall Panel – Tech Four, Roof Panel - SSR
 - 3. Butler Manufacturing Company; Wall Panel – StylWall II Fluted Wall System, Roof Panel - MR24

2.2 STRUCTURAL-FRAMING MATERIALS

- A. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- C. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
- F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70.
- G. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.
- H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.
- I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- J. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
 2. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.
 - a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- K. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
- L. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy hex carbon steel.
 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 4. Washers: ASTM F 436 hardened carbon steel.
 5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- M. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 1. Nuts: ASTM A 563 heavy hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436 hardened carbon steel.
 4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- N. Threaded Rods: ASTM A 193/A 193M.
 1. Nuts: ASTM A 563 heavy hex carbon steel.
 2. Washers: ASTM F 436 hardened carbon steel.
 3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- O. Primer: SSPC-Paint 15, Type I, red oxide.

2.3 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80, with G90 coating designation.
 2. Surface: Smooth, flat finish.
 3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings:
 - a. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions, except as modified below:
 - 1) Humidity Resistance: 2000 hours.
 - 2) Salt-Spray Resistance: 1000 hours.
 - b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

2.4 PRE-ENGINEERED BUILDING LINER SYSTEM INSULATION FOR WALLS AND ROOFS

- A. Pre-engineered Building Liner System Insulation: ASTM C 991, Type I, or NAIMA 202, preformed formaldehyde-free glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
 - 1. Thermal Resistance of Installed System: Roof – U-0.035; Walls – U-0.052
- B. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96, Desiccant Method meeting UL 723/ASTM E84 Flame Spread and Smoke Contribution. System shall provide a continuous vapor barrier inside of building purlins, girts, and insulation to provide complete isolation from inside conditioned air.
 - 1. Composition: woven, HPDE Scrim facing, bright white, LRV – 84.
- C. Retainer Strips: 0.019-inch- thick, formed, galvanized steel or PVC retainer clips colored to match insulation facing.
- D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- E. Thermal Blocks: 1"x3" extruded polystyrene
- F. Approved Manufacturer's: Skyliner Insulation Systems by Bay Industries; Simple Saver System by Thermal Design, Inc., CGI Silvercote Energy Saver System.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 - 2. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with nylon or polypropylene washer.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Metal Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing.
 - 2. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant.

2.6 FABRICATION, GENERAL

- A. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

- B. Metal Panels: Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.7 STRUCTURAL FRAMING

A. General:

1. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - a. Make shop connections by welding or by using high-strength bolts.
 - b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
 - c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - d. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.
2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - a. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.

- B. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing. Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

1. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
2. Frame Configuration: Single gable.
3. Exterior Column Type: Tapered.
4. Rafter Type: Tapered.

- C. End-Wall Framing: End wall framing shall be Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

- D. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch-thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
 - a. Depth: Nominal 8"

2. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch- wide flanges.
 - a. Depth: Nominal 8"
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary frame flanges.
 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 6. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch zinc-coated (galvanized) steel sheet.
 7. Purlin and Girt Clips: Minimum 0.0598-inch- thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch- thick, zinc-coated (galvanized) steel sheet.
 9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch- thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- E. Bracing: Provide adjustable wind bracing as follows:
1. X-shaped Rod/Cable Bracing: Fabricate from structural-steel rods/cables or structural-steel shapes to match primary framing; of size required to withstand design loads. Locate braces as shown in the Architectural plans.
- F. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide hot-dipped galvanized bolts for structural-framing components that are galvanized.
- G. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.
1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil.
 - a. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
 2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

2.8 METAL ROOF PANELS

- A. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal 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) steel sheet, 24 gauge.
 - a. Exterior Finish: Fluoropolymer.
 2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel sheet.
 3. Joint Type: Mechanically seamed, folded as standard with manufacturer.
 4. Panel Coverage: 24 inches.
 5. Panel Height: 3 inches.

2.9 FIELD-ASSEMBLED METAL WALL PANELS

- A. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced between major valleys; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized) steel sheet, 26 gauge.
 - a. Exterior Finish: Fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 12 inches o.c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: 0.75 inches.
 - 5. Panels to be sufficient to support brick veneer with maximum L/360 deflection.

2.10 FACE-APPLIED HORIZONTAL ACCENT METAL WALL PANELS

- A. Ribbed Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys; designed to be field assembled by lapping side edges of adjacent panels and horizontally mechanically attaching panels over face of vertical metal building wall panels using exposed fasteners in side laps. Provide top, bottom and outside corner matching metal trim.
 - 1. Material: Zinc-coated (galvanized) steel sheet, 26 gauge.
 - a. Exterior Finish: Fluoropolymer.
 - b. Color: Metallic Paint Finish, As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 6 inches o.c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: .75 inches.

2.11 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including rake trim, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated. Rake trim finish and color to match wall panels.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 - 2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
 - 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
 - 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Formed from minimum 0.0159-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels, except flashing above panelized stone veneer to be contrasting color trim.
 - 1. Opening Trim: Minimum 0.0159-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings. Color to match adjacent wall panels.
- E. Gutters: Formed from minimum 0.0159-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof panels and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - 1. Gutter Supports: Fabricated from same material and finish as gutters; spaced 36 inches o.c.
- F. Downspouts: Formed from 0.0159-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
 - 1. Mounting Straps: Fabricated from same material and finish as gutters; spaced 10 feet o.c.
- G. Snow Bars: Snow Bars: Provide snow bars where indicated on drawings equal to Snoblox-Snojax "ColorRail", 6061-T6 aluminum bar powder coated to match the roof panels. 12 ga. one-piece stainless steel clamps with two "cup tipped" stainless steel set screws are provided at each roof seam.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.12 SOURCE QUALITY CONTROL

- A. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special Inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
 - 1. Special inspections will not be required if fabrication is performed by a manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit certificate of compliance with copy to authorities having jurisdiction certifying that Work was performed according to Contract requirements.
- B. Tests and Inspections:

1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1.

PART 3 - EXECUTION

3.1 ERECTION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.
- B. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- C. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- D. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- E. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- F. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure.
- G. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and snug-tightened or pretensioned joints.
- H. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.

3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.2 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 5. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.

3.3 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Install ridge caps as metal roof panel work proceeds.
- B. Field-Assembled, Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 1. Install clips to supports with self-tapping fasteners.

2. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
5. Provide metal closures at rake edges and each side of ridge caps.

3.4 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. When two rows of metal panels are required, lap panels 4 inches minimum.
 2. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
 4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 5. Install screw fasteners in predrilled holes.
 6. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
 7. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
 8. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Field-Assembled, Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.5 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL PANELS

- A. General: Install Pre-engineered building insulation liner system in accordance with manufacturer's installation instructions and approved shop drawings. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Install in exterior spaces without gaps or voids. Do not compress insulation. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids. Fit insulation in tight spaces and tight to exterior side of the sealed liner fabric and around mechanical and electrical services within the plan of insulation.
 1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths with both sets of facing tabs sealed to provide a complete vapor retarder.
 4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation with both sets of facing tabs sealed to provide a complete vapor retarder.
- B. Roof Insulation: Comply with the following installation method:

1. Straps: Cut straps to length and install in the pattern and spacings indicated on shop drawings. Tension straps to required value.
 2. Vapor Barrier Fabric: Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing. Position pre-folded fabric on the strap platform along one eave purlin. Clamp the two bottom corners at the eave and also centered on the bar. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlins. Once positioned, install fasteners from the bottom side at each strap purlins intersection. Trim edges and seal along the rafters. All seams must be completely sealed and stapled seams not acceptable.
 3. Insulation: Unpack, and shake to a thickness exceeding the specified thickness. Ensure that cavities are filled completely with insulation. Place on the vapor barrier liner fabric without voids or gaps. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied. Place thermal block on top of purlins. Place new insulation between purlins at the required thickness for the thermal performance specified. Seal vapor barrier to the wall fabric and elsewhere as required to provide a continuous vapor barrier.
- C. Blanket Wall Insulation: Comply with the following installation method:
1. Insulation: Install thermal break to exterior surface of girts as wall sheathing is applied. Install self-sticking foam thermal break to interior surface of girts prior to installation of insulation. Position and secure hangers to girts on the inside face of the wall sheathing. Cut insulation to required lengths to fit vertically between girts. Fluff the insulation to the full-specified thickness. Neatly position in place and secure to hangers. Ensure that cavities are filled completely with insulation.
 2. Vapor Barrier Fabric: Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing. Apply the vapor barrier fabric by clamping it in position over the eave strap and installing fasteners through the eave strap into each roof strap, permanently clamping the wall fabric between them. Once in position, draw the vapor barrier fabric down over the column flanges to the base angle and install vertical straps along each column and 5'-0" o.c., maximum, fastening to each girt to retain system permanently in place. All seams must be completely sealed and stapled seams not acceptable. Seal wall fabric to the roof fabric, to the base angle and up the columns to provide a continuous vapor barrier.

3.6 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.

- C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Tie downspouts to underground drainage system indicated.
- E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.7 FIELD QUALITY CONTROL

- A. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports.
- B. Tests and Inspections:
 - 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1.

3.8 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 133419

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

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 fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.

1.3 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
- B. The proposed sprinkler system shall be designed to meet NFPA 13 requirements without the use of a fire pump.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Sprinkler Occupancy Hazard Classifications: As shown on the Drawings in accordance with applicable NFPA standards and subject to the approval of the authorities having jurisdiction.
 - 2. Minimum Density Sprinkler Piping Design: As shown on the Drawings in accordance with applicable NFPA standards and subject to the approval of the authorities having jurisdiction.
 - 3. Maximum Protection Area per Sprinkler: According to applicable NFPA standards and UL listing requirements, unless otherwise indicated.
 - 4. Total Combined Hose-Stream Demand Requirement: According to applicable NFPA standards, unless otherwise indicated:
- C. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials including sprinkler specialty fittings.
 - 2. Pipe hangers and supports.
 - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 5. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 - 6. Alarm devices, including electrical data.
 - 7. Backflow preventer. Include pressure drop chart, and dimensioned drawing
- B. Fire-hydrant flow test report.
- C. Approved Sprinkler Piping Drawings: Design drawings, prepared according to NFPA 13, bearing the stamped approval of the authorities having jurisdiction, including hydraulic calculations.
 - 1. Design drawings shall include the complete overhead sprinkler system and all other potential construction interferences: HVAC diffusers, light fixtures, structural steel, etc
 - 2. Design drawing shall include a plan showing the location of underground connections, control valves, and related items
 - 3. Design drawings shall include any details and section necessary to clarify the design.
 - 4. Design drawings shall be stamped by the professional engineer retained by the Installer and described in the Quality Assurance section of this Specification.
 - 5. Design drawings shall show the location of all alarm devices to be connected to the Fire Detection and Alarm System.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "[Contractor's Material and Test Certificate for Aboveground Piping](#)" and "Contractor's Material and Test Certificate for Underground Piping."
 - 1. Two (2) completed copies are to be provided to the Engineer
 - 2. One (1) completed copy shall be provided to the authority having jurisdiction
- E. Operation Manual: Provide three (3) hard copies in separate binders and an electronic copy. Include the following:
 - 1. Copy of product data
 - 2. Copy of fire hydrant test report
 - 3. Copy of Sprinkler Piping Diagrams
 - 4. Copy of Contractor's Material and Test Certificate for Aboveground Piping
 - 5. Copy of final letter of acceptance from authority having jurisdiction
 - 6. Schedule and description of required maintenance activities
- F. Provide two (2) copies of the final letter of acceptance from the authority having jurisdiction after the system has been completely installed, tested, and accepted.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test performed by the installer.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer licensed in the state which the project is located.
 - b. Installer shall be a company specializing in the installation of Fire Protection Systems with a minimum of three (3) years experience.
- B. Perform work in accordance with the Fire Rating Bureau having jurisdiction, the applicable NFPA Standard listed below, and Factory Mutual Standards.
 1. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13, "Installation of Sprinkler Systems."
- C. Equipment and Components shall bear FM label or marking.

1.7 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Coordinate alarm, trouble and supervisory signals originating at equipment supplied under this Section with the fire detection and alarm system.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project. Location of cabinet(s) shall be coordinated with Engineer.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and/or required with factory- or field-formed threaded ends.
 1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated and/or required. Include ends matching joining method.

- 4. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated and/or required.
- B. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.
 - a. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - b. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.2 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

2.3 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
 - 1. NPS 2 and smaller: Bronze body with ends matching connecting piping.
- C. Butterfly Valves: UL 1091.
 - 1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; with flanged or grooved ends.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
- E. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and ends matching connecting piping.
 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; with flanged or grooved ends.

2.4 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and ends matching connecting piping.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and ends matching connecting piping.

2.5 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1767, for early-suppression, fast-response applications.
- C. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- D. Sprinkler types, features, and options as follows:
 - 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Extended-coverage sprinklers.
 - 3. [Flush ceiling sprinklers](#), including escutcheon.
 - 4. Pendent sprinklers.
 - 5. Pendent, dry-type sprinklers.
 - 6. Quick-response sprinklers.
 - 7. Sidewall sprinklers.
 - 8. Sidewall, dry-type sprinklers.
 - 9. Upright sprinklers.
- E. Sprinkler Finishes: Chrome plated and bronze.
- F. Special Coatings: Wax.
- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.6 FIRE DEPARTMENT CONNECTIONS

- A. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR."

1. Type: Flush with two inlets and square or rectangular escutcheon plate.
2. Finish: Rough chrome plate

2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- C. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.8 PRESSURE GAGES

- A. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig.
 1. Water System Piping: Include caption "WATER" on dial face.

2.9 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 1. Standard: ASSE 1013 or AWWA C511.
 2. Operation: Continuous-pressure applications.
 3. Pressure Loss at Design Flow Rate: <Insert psig> or less.
 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
 5. End Connections: Matching connecting piping for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 6. Configuration: Designed for horizontal, straight through flow.
 7. Backflow preventer shall be fully supported independent of connecting piping.
 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

2.10 VALVE SEALS, TAGS, CHARTS, and NAMEPLATES

- A. Seals: Brass cross-linked chain, all brass padlocks, and two keys for each manually operated shutoff valve required to be sealed in the open position.
- B. Signs: Provide identification signs of standard design, fastened securely at designated locations in accordance with NFPA 13.
- C. Tags: Provide 2" diameter brass tags, stamped with designation numbers, secured with 12 gauge copper wire to spindle of each valves.

- D. Charts:
1. Provide two copies of the approved "As-Built" sprinkler system diagram and valve chart, giving designated number, function, and location of each valve. Scale of diagram shall be such that it can be easily read.
 2. Place one copy behind a clear plastic cover with aluminum frame and locate where directed by the Engineer. Provide the second copy to the Owner.
 3. Provide sign below frame: "Sprinkler System Diagram"
- E. Nameplates: Provide permanently marked weatherproof metal or rigid plastic sign secured with corrosion-resistant chain at the base of all risers within the facility. Nameplate shall include the following information:
1. Location of the design area or areas
 2. Discharge densities over the design area or areas
 3. Required flow and residual pressure demand at the base of the riser
 4. Occupancy classification or commodity classification and maximum permitted storage height and configuration
 5. Hose stream allowance included in addition to the sprinkler demand
 6. Name of the installing contractor

2.11 JOINING MATERIALS

- A. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated, and full-face, unless otherwise indicated
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated

2.12 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.13 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.14 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.
- C. Fire-hydrant flow data provided within this Specification or the Drawings is provided only for preliminary planning purposes and shall NOT be used as the basis for final design calculations for the system and does not relieve the installer of the requirement to perform a fire hydrant flow test.

3.2 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
 - 1. NPS 2 and smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints; or grooved-end, black or galvanized.
 - 2. NPS 2-1/2 to NPS 6: Grooved-end, black, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints

3.4 VALVE APPLICATIONS

- A. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.5 WATER SUPPLY

1.

- A. Connect fire-suppression piping to either the water-service entrance piping or the interior water distribution piping as indicated on the Drawings.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories as needed or indicated on the water supply connection detail.

3.6 PIPING INSTALLATION

- A. Locations and Arrangements: Where locations, elevations, or piping schematics are provided on the Drawing, the piping shall be installed as indicated, as far as practical. Bring to the attention of the Engineer any requested or required deviations. Where specific location and arrangement information is not provided:
 - 1. In areas having ceilings, conceal all pipes.
 - 2. In storage and service areas, pipe may be exposed but hold to the minimum practicable distance below the ceiling.
- B. Do NOT install piping within the attic or any other un-heated spaces.
- C. Do NOT install piping within exterior walls.
- D. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.
- H. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- I. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- J. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections. Flanges are not required in piping installations using grooved joints except for valves, apparatus, and equipment specifically required to utilize a flange connection.
- K. In areas where a future ceiling may be installed, 1 inch minimum outlets shall be provided with hexagonal bushings to accommodate sprinklers attached directly to the branch line to allow for future system modifications. All areas where the distance from the floor to the bottom of the lowest structural member is 15 feet or less shall be considered an area where a future ceiling may be installed unless indicated otherwise by the Engineer in writing.
- L. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- M. Install sprinkler piping with drains for complete system drainage.
- N. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

- O. Install alarm devices in piping systems.
- P. Hangers and Supports: Comply with NFPA 13 for hanger materials.
- Q. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- R. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS ¼ and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- S. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Exposed Piping at Wall and Ceiling Penetrations: One-piece, stamped-steel
- T. Sleeves are not required for core-drilled holes.
- U. Install sleeves for pipes passing through interior concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint.
- V. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- W. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- X. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- Y. Fill wet-pipe sprinkler system piping with water.

3.7 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40. Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Steel Pipe: Roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

3.8 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 - 1. Provide identifications tag on each valve.
 - 2. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
 - 3. Install valve seals for all manual shutoff valves required to be sealed in the open position.

3.9 SPRINKLER APPLICATIONS

- A. Sprinkler types indicated on Drawings shall be used when provided. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Flush sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Pendent or Sidewall, dry sprinklers.

5. Special Applications: Extended-coverage and quick-response sprinklers when necessitated by occupancy.
6. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Flush Sprinklers: Bright chrome, with painted white escutcheon.
7. Sprinkler Protection: Provide wire cage guards on sprinklers subject to physical damage.

3.10 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.11 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.12 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.13 FIELD TEST REPORTS AND CERTIFICATES

- A. Complete the "Contractor's Material and Test Certificate for Aboveground Piping".
 1. Contractor to fill out all sections of the certificate. "NA" shall be entered in any sections not pertaining to the project.
 2. Contact Engineer at least 48 hours prior to the proposed tests
 3. Provide copies to Engineer and authority having jurisdiction as described in Part 1 of this section.

3.14 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Concrete bases.
 - 9. Supports and anchorages.

1.2 SUBMITTALS

- A. Shop Drawings – Prior to purchase, submit for Engineer/Architect's review complete shop drawings for the following:
 - 1. Plumbing fixtures and specialties.
- B. Welding Certificates.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, and spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 QUALITY ASSURANCE

- A. Standards: Any procedure, material or operation specified by reference to applicable standards or codes shall comply with the current or most recent edition. In conflicts between listed standards, the more stringent shall govern.
 - 1. Applicable Standards:
 - a. International Plumbing Code, latest edition
 - b. International Fuel Gas Code, latest edition
- B. Contractor shall obtain all necessary permits and arrange for all inspections required by State or Local authorities.
- C. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- D. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- F. Materials must be new, in first class condition. Work must be done by trained, experienced, skilled journeyman (woman) under an approved full time supervisor, with every possible precaution taken by contractor to assure safety of all persons of all categories.

1.5 GUARANTEE

- A. Each entire overall installation, including every special item, device, and part and every specialized system shall be fully guaranteed from standpoint of satisfactory performance, safety, workmanship and material for one year after formal written acceptance by Engineer/Architect, any unsuitable, unsatisfactory, noisy, ineffective, defective, improperly sized or applied equipment or material, or unacceptable workmanship shall be quickly replaced or modified during guarantee period or any extension thereof, as directed and as approved by Engineer/Architect in writing.
- B. Individual items and systems shall be guaranteed for the same period in addition to the above regardless of any limitations of manufacturer's guarantee period.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

- E. PVC Pipe: ASTM D 1785, Schedule 40.
- F. Molded PE: Reusable, PE, tapered-cup shaped and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Quantities Required and Clarifications:
 - 1. Contractor shall determine quantities required from drawings and job conditions except that where specifications call for specific quantities, these quantities shall also govern. If there is conflict between quantities called for on drawings and in specifications, greater quantity shall govern.
 - 2. Where an item is specified by a manufacturer's number, such number is for general information only, and shall be modified by any additional data, size, etc., which may be shown and/or specified. Where there is conflict between number and other data, it shall be contractor's responsibility to request clarification from Engineer/Architect.
 - 3. Where clarification is required for any purpose, including discrepancies within written specifications on drawings, or between them, it shall be contractor's responsibility to request such clarification from Engineer/Architect at least 7 days before Bids are due and in all cases subsequent interpretations or clarifications made by Engineer/Architect shall be final.
- B. Cleaning:

1. Piping, conduit, equipment, devices, etc. shall be thoroughly cleaned before being offered for acceptance.
2. The following shall be thoroughly cleaned, or finished out, or blown out before installation is offered for acceptance.
Plumbing equipment, fixtures, devices, etc.
3. Labels, stickers, temporary protection, etc. shall be removed and work shall be provided contractor without increase in contract price.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for exposed penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.

- H. Cure placed grout.

3.10 EXCAVATION AND BACKFILLING

- A. Depth of bury of cover over exterior underground construction shall not be less than the following, unless otherwise noted or required.
 - 1. Sewers: 4'-0".
 - 2. Water pipes : 4'-0" .
- B. Contractor shall do excavation required to install his (her) work, including pockets as required for fittings, etc., and after same are in place and tested and approved, he (she) shall replace drives, curbs and remove surplus earth and debris from the premises as directed by Architect. Backfill under structures or pavement and within 5'-0" of same shall be thoroughly compacted aggregate. After installing pipe, backfill with compacted aggregate to 95% standard proctor density in 8" maximum lifts. Sand may be used for bedding the pipe, but shall be free of debris, rock, concrete, etc. and settled with water in layers as directed by Engineer/Architect. No materials except clean sand shall be placed within 6" of any pipe, sewer, conduit, cable or metal part.
- C. Excessive excavations, excavations required to reach undisturbed soil, lower trenches, etc., shall be filled with thoroughly compacted small sized gravel to provide adequate bedding and support. Lines shall be bedded on materials at least 2" thick.
- D. No trenches shall be filled until work has been inspected and approved by Engineer/Architect.

3.11 PRESSURE TESTS

- A. Test shall be applied in Engineer/Architect's presence to all equipment, valves, devices, and piping, in groups or sections as work progresses. Unless otherwise noted, tests shall be made with water, after piping and equipment have been completely vented. Pressure shall be maintained for at least four hours without drop or visible leak. If leaks appear, they shall be repaired by replacing defective material or workmanship (peining, swaging or caulking will not be permitted), refill system with water, completely vented, and repeat test as often as necessary to show no drop in 2 hours. After tests, systems shall be completely drained. Precautions shall be taken to prevent freezing of test water and to protect or remove devices or equipment, or parts thereof, controls, gauges, thermometers, etc. which may be harmed by test pressures. Tests shall be made before painted and before covering.
- B. Piping etc., shall be tested to at least 125 psi.
- C. After pressure test, each complete system, piping and equipment shall be tested for complete drainage by opening unions, caps, plugs, faucets, or hose valves at low points. If system does not drain completely, piping shall be regraded and/or drain points added until complete drainage is demonstrated to Engineer/Architect. Systems shall be left dry in freezing weather.

END OF SECTION 220500

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Palmer - Wahl Instruments Inc.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or brass, 7 inches long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.

- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

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

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Metal.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

- C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install thermometers in the outlet of each domestic, hot-water storage tank.

- B. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
 - 2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install pressure gages for discharge of each pressure-reducing valve.
- B. Install pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage.
- E. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- F. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 220519

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze swing check valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Lead-Free, Bronze Ball Valves with Bronze Trim: Lead-Free

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 400 psig minimum.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded or Soldered.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.

- j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or Soldered
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 4 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.3 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 4 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 220523

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.
 - 3. B-Line Systems, Inc.; a division of Cooper Industries.
 - 4. Carpenter & Paterson, Inc.
 - 5. Empire Industries, Inc.
 - 6. ERICO/Michigan Hanger Co.
 - 7. Globe Pipe Hanger Products, Inc.
 - 8. Grinnell Corp.
 - 9. GS Metals Corp.
 - 10. National Pipe Hanger Corporation.
 - 11. PHD Manufacturing, Inc.
 - 12. PHS Industries, Inc.
 - 13. Piping Technology & Products, Inc.
 - 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.

- f. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

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

2.7 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Piping Hanger Spacing:

Pipe Size	Distance From Sleeve In Wall, End, Offset Or Corner to Hanger (Max.)	Hanger Spacing (Max.)
Up to 1¼"	2'-0"	8'-0"

1½ , 2"	3'-0"	10'-0"
2½" & Up	3'-0"	12'-0"

- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

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

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

3.4 METAL FABRICATIONS

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

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

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

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

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

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- C. Pipe Label Color Schedule:
 1. Domestic Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Green.
 2. Sanitary Waste, Sanitary Vent, Condensate, and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.
 3. Natural Gas Piping
 - a. Background Color: Yellow
 - b. Letter Color: Black

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - 2. Adhesives.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. RBX Corporation; Rubatex Contact Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

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

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the

connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 PIPING INSULATION SCHEDULE, GENERAL

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

3.7 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:
 1. Flexible Elastomeric: 1 inch thick.
- B. Domestic Cold Water (Potable): Insulation shall be:
 1. Flexible Elastomeric: 1/2 inch thick.
- C. Exposed Sanitary Drains, Domestic Cold Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be:
 1. Flexible Elastomeric: 1 inch thick.
- D. Condensate Drains: Insulation shall be:
 1. Flexible Elastomeric: 1/2 inch thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.
 - 3. Flexible connectors.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install domestic water piping level and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping adjacent to equipment and specialties to allow service and maintenance.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- N. Install thermometers on outlet piping from each water heater.

2.6 JOINT CONSTRUCTION

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

2.7 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 4 and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

2.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

2.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment and machines to allow service and maintenance

2.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

- D. Domestic water piping will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports.

2.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

2.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground domestic water piping, shall be one of the following:
 1. Hard copper tube, ASTM B 88, Type L, cast or wrought copper solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L, copper pressure-seal-joint fittings; and pressure-sealed joints.

2.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use ball valves for piping NPS 4 and smaller.
 2. Throttling Duty: Use ball valves for piping NPS 4 and smaller.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, soil and waste Piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and

reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise required by code or indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Temperature-actuated water mixing valves.
 - 4. Strainers.
 - 5. Hose bibbs.
 - 6. Wall hydrants.
 - 7. Drain valves.
 - 8. Water hammer arresters.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 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:

- a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Rough bronze or chrome plated.

B. Hose-Connection Vacuum Breakers:

- 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:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Woodford Manufacturing Company.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1001.
- 3. Body: Bronze, nonremovable, with manual drain.
- 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- 5. Finish: Rough bronze or chrome plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

- 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:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1013.
- 3. Operation: Continuous-pressure applications.

4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: Per manufacturer's recommendations.
6. Design Flow Rate: Per manufacturer's recommendations.
7. Selected Unit Flow Range Limits: Per manufacturer's recommendations.
8. Pressure Loss at Design Flow Rate: 15 psig or as necessary to ensure domestic water pressure as required by governing codes.
9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Provide the product listed in the plumbing fixture schedule or equivalent product by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - c. Strainers NPS 5 and Larger: 0.125 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.5 HOSE BIBBS

- ### **A. Hose Bibbs: Basis-of-Design Product: Provide the product listed in the plumbing fixture schedule or equivalent product by one of the following:**

1. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Watts Drainage Products Inc.
3. Woodford Manufacturing Company.
4. Zurn Plumbing Products Group; Light Commercial Operation.

2.6 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants: Basis-of-Design Product: Provide the product listed in the plumbing fixture schedule or equivalent product by one of the following:
- a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Tyler Pipe; Wade Div.
 - c. Watts Drainage Products Inc.
 - d. Woodford Manufacturing Company.
 - e. Zurn Plumbing Products Group; Light Commercial Operation.

2.7 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 2. Pressure Rating: 400-psig minimum CWP.
 3. Size: NPS 3/4.
 4. Body: Copper alloy.
 5. Ball: Chrome-plated brass.
 6. Seats and Seals: Replaceable.
 7. Handle: Vinyl-covered steel.
 8. Inlet: Threaded or solder joint.
 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
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:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASSE 1010 or PDI-WH 201.
 3. Type: Metal bellows or Copper tube with piston.
 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- D. Install water hammer arresters in water piping according to PDI-WH 201.
- E. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- F. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- G. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Primary, thermostatic, water mixing valves.

3.2 FIELD QUALITY CONTROL

- A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.
 - 4. Flashing materials.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
 - 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:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: As required to match connected piping.
 - 5. Closure: Raised-head, plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:

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:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Inside calk.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron.
9. Frame and Cover Material and Finish: Polished bronze.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Top or Strainer Material: Bronze.
7. Top of Body and Strainer Finish: Nickel bronze.
8. Top Shape: Round.
9. Trap Pattern: Deep-seal P-trap.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

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:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
 - c. Wrisco Industries Inc.

B. Description: Manufactured assembly made of 0.064-inch-thick, aluminum manufactured to CSA B272-93 with EPDM triple pressure grommet seal and EPDM Base Seal.

1. Warranty: 20-year against leaks, condensation, and defects in materials and/or manufacture.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

B. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 223400 - FUEL FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following fuel-fired water heaters:
 - 1. Commercial, power-burner, storage, gas water heaters.
 - 2. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s):
 - a. Commercial, Gas Water Heaters: Three years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS WATER HEATERS

A. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.

1. Available Manufacturers:

- a. Bradford White Corporation.
- b. Precision Boilers.
- c. PVI Industries, LLC.
- d. RECO USA.
- e. Sellers Engineering Co.
- f. Smith, A. O. Water Products Company.

2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

- a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

3. Factory-Installed, Storage-Tank Appurtenances:

- a. Anode Rod: Replaceable magnesium.
- b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
- c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
- d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
- e. Jacket: Steel with enameled finish.
- f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas fuel.

- a. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.

5. Temperature Control: Adjustable thermostat.

6. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

7. Special Requirements: NSF 5 construction.

8. Draft Hood: Draft diverter; complying with ANSI Z21.12.

9. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.

B. Capacity and Characteristics:

1. As specified on plan sheets.
2. Electrical Characteristics: As specified on plan sheets.
3. Minimum Vent Diameter: Per manufacturer's recommendations and National Fuel Gas Code, latest edition.

2.2 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.
 1. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

END OF SECTION 223400

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUBMITTALS

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

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. See Plumbing Schedule on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install toilet seats on water closets.
- L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install traps on fixture outlets:
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

- Q. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
 - 2. Fixture supports.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

- A. Water Coolers: See Plumbing Fixture Schedule on Drawings.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

END OF SECTION 224700

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 225000 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.2 SUBMITTALS

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

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - 4. Corrugated stainless-steel tubing with polymer coating.

5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.

2.4 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

2.5 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Carbon steel.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.7 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.2 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing.

3.3 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 2. Cut threads full and clean using sharp dies.
 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.5 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.6 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- B. Natural gas piping shall be cleaned to remove all dirt, oil, and grease and then primed with an acrylic primer and two coats of enamel paint.

3.7 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 2 and smaller shall be the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.

3.9 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 225000

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Escutcheons.

1.2 SUBMITTALS

- A. Submit product information for all materials used for the various mechanical systems.

1.3 REFERENCES

- A. Standards:
 - 1. ASME American Society of Mechanical Engineers.
 - 2. ANSI American National Standard Institute.
 - 3. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.5 QUALITY ASSURANCE

- A. All equipment and materials shall be new and of first quality. Manufactured products shall be Manufacturer's standard product with specified options but shall not be field or factory modified unless specified. All materials and equipment shall bear the Manufacturer's nameplate or marking with type, size, catalog numbers and ratings as appropriate.

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Acceptance (at site): Take delivery of all items delivered to site. Be responsible for inspection of materials and equipment to detect transit damage.
- B. Protection (prior to application or installation):
 - 1. Materials shall be stored inside building. Piping may be stored outside.
 - 2. Be responsible for all damage to materials stored on site.

1.7 PROJECT CONDITIONS

- A. When existing conditions prohibit the proper installation as shown on the Drawings or as specified herein, the Contractor shall notify the Engineer/Architect, in writing, requesting a solution.
- B. Contractor is responsible for the verification of new and existing conditions on the site before that particular phase of installation begins.

1.8 WARRANTY

- A. Contractors and manufacturers warranty shall be 1 year after substantial completion.

PART 2 - PRODUCTS

2.1 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.2 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated Rough brass Polished chrome-plated and rough brass.

PART 3 - EXECUTION

3.1 TESTING OF PIPING SYSTEMS

- A. Piping Systems:
 - 1. Contractor shall subject all piping and equipment to a test of 125 psi for a period of 8 hours and all leaks developed shall be repaired and the test repeated until the system is absolutely tight.
 - 2. Disconnect all traps and devices not rated for operation at test pressures.
 - 3. All instruments and equipment required for testing shall be furnished by the Contractor and tests shall, if so requested, be made in the presence of the Engineer/Architect.

3.2 ADJUST AND CLEAN

- A. Protection of Completed Work:
 - 1. When work is completed it shall, when it is subject to damage by ongoing construction, be protected from this damage.
 - 2. As work is being installed, equipment and piping shall be protected from other ongoing construction or from its own construction. Exposed piping ends should not be temporarily covered; hanger shall be supplied in sufficient number to prevent warping or bending of pipe.

END OF SECTION 230500

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Duct labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black Blue Red White Yellow Insert color.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 DUCT LABELS

- A. General Requirements for Manufactured Duct Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Duct Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- E. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

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

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.
2. Condensate Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
3. Natural Gas Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, Adjusting, and Balancing of:
 - 1. Air conditioning equipment including air distribution devices, supply ducts, air handling units, condensing units, fans, coils, and related equipment.

1.2 REFERENCES

- A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) – TAB Procedural Guide – Endorsed by Testing, Adjusting and Balancing Bureau (TABB)
- C. Associated Air Balance Council (AABC) – National Standards for Total System Balance.
- D. National Environmental Balancing Bureau (NEBB) – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 DEFINITIONS

- A. Adjusting: Varying of system flow by modifying settings of dampers and valves, in combination with varying fan speeds to obtain optimum operating conditions for the HVAC system.
- B. Balancing: Proportioning of air and hydronic flows through system mains, branches, and terminal devices using standardized procedures to obtain specified air or hydronic flow while imposing the least amount of restriction on the HVAC system.
- C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air and hydronic flow in velocities or quantities used in evaluating the performance of the HVAC system.

1.4 SUBMITTALS

- A. Reports
 - 1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.
 - 2. TAB Report: Electronically Submit the complete testing, adjusting and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.
 - 3. Reports shall be on TABB/SMACNA, AABC, or NEBB forms that indicate information addressing each of the testing methods, readings, and adjustments.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Testing and Balancing shall be performed by a testing agency who specializes in testing, adjusting, and balancing of heating, ventilating, air-moving equipment, air- conditioning systems and hydronic systems and has a minimum of one year experience.
 - 2. Testing agency shall have successfully completed a minimum of five projects, similar in size and scope.
 - 3. Testing agency shall be a certified member of TABB, AABC, and/or NEBB.
- B. Certifications
 - 1. TAB Technician shall be certified by a nationally recognized certifying agency
- C. Perform total system balance in accordance with one of the following:
 - 1. TABB – Quality Assurance Program.
 - 2. AABC – National Standards for Field Measurement and Instrumentation.
 - 3. NEBB Quality Assurance Program – Conformance Certification.

1.6 PROJECT CONDITIONS

- A. Testing, adjusting, and balancing shall commence after HVAC systems installation is complete and in working order. Associated areas of general construction shall be in place including interior and exterior doors, windows, walls, and ceilings.

1.7 SPECIAL WARRANTY

- A. Provide warranty for period of 90 days following submission of completed report, during which time Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencing the testing, adjusting, and balancing of environmental system(s), verify the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed, complete, and operable.
 - 3. Automatic and manual dampers are operable and fully open.
 - 4. Thermal overload protection is in place for fans, pumps, chillers, and other equipment.
 - 5. Start up air filters are removed.
 - 6. Final filters are clean and properly installed.
 - 7. Duct and fan systems are clean.
 - 8. Fans are rotating correctly.
 - 9. Fire and volume dampers are in place and open.
 - 10. Air coil fins are cleaned and combed.
 - 11. Access doors are closed and duct end caps are in place.
 - 12. Air outlets are installed and connected.

13. Start-up/construction strainers have been removed and all permanent strainers are clean and in place.
 14. Gauges and/or test ports are properly located for balancing.
 15. Service and balance valves are fully open.
- B. If deficiencies are evident, submit Deficiency Report to Architect. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied.

3.2 SITE TOLERANCES

- A. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.
- B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design for the space.
- C. Hydronic Systems: Adjust to within 10 percent of design flow.
- D. Hydronic Terminal Devices: Adjust to within plus or minus 10 percent of design flow.

3.3 AIR SYSTEM PROCEDURE

- A. Adhere to the following procedure:
1. TABB – SMACNA TAB Procedural Guide, with particular focus on the following chapters:
 - a. Preliminary TAB Procedures.
 - b. General Air System TAB Procedures.
 - c. TABB Procedures for Specific Air Systems.
 2. AABC – National Standards for Total System Balance.
 3. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- B. Minimum air procedures should include the following:
1. Test and adjust fan RPM to design requirements.
 2. Test and record motor full load nameplate rating and actual ampere draw
 3. Test and record system static pressures, fan suction, and discharge.
 4. Adjust all main supply and return air duct to within tolerances of proper design CFM.
 5. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity (FPM) and adjusted velocity, design CFM, and adjusted CFM.
 6. Test and record outside air, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
 7. In coordination with the Mechanical contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
 8. Test and adjust air handling and distribution systems to provide required supply, return, outside, and exhaust air quantities within design tolerance.
 9. Make air velocity measurements in ducts by Pitot tube traverse across entire cross- sectional area of duct in accordance with SMACNA equal area method or Log Linear method.
 10. Measure air quantities at all air inlets and outlets.
 11. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels.
 12. Vary total system air quantities by adjustment of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.

13. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
14. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances.
15. Where modulating dampers or economizers are provided, take measurement at full return air, minimum outside air, and 100% outside air mode of operation.

3.4 ADJUSTING

- A. Recorded data shall represent actual measured or observed conditions.
- B. Permanently mark the setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- C. Final report to include identification of all key outlets, key branches, and key trunks in each air system that shows a critical path of no dampening from the fan to terminal device.
- D. Leave systems in proper working order by: replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Field-applied jackets.
 - 7. Tapes.
 - 8. Securements.
- B. Related Sections:
 - 1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 COORDINATION

- A. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: Black.

2.4 SEALANTS

A. PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Black.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: Black, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Black, Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Black, Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: Black.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

1. Finish and thickness are indicated in field-applied jacket schedules.
2. Paint black after installation.

2.7 TAPES

A. ASJ Tape: Black vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: Black vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Width: 2 inches.
 2. Thickness: 6 mils.
 3. Adhesion: 64 ounces force/inch in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch in width.

2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

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

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 2. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 2. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Pipe: Install insulation continuously through floor penetrations.
 - 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 16 inches and smaller, no pins required.

- b. On duct sides with dimensions larger than 16 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 16 inches and smaller, no pins required.
 - b. On duct sides with dimensions larger than 16 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor supply and outdoor air.
 - 2. Indoor return air.
 - 3. Indoor, exhaust between isolation damper and penetration of building exterior.
 - 4. Outdoor, supply and return.
- B. Items Not Insulated:
 - 1. Factory-insulated flexible ducts.
 - 2. Factory-insulated access panels and doors.

3.9 INDOOR DUCT INSULATION SCHEDULE

- A. Concealed, Supply Air, round, duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2-1/8 inches thick and 0.75-lb/cu. ft. nominal density with factory FSK jacket.
- B. Concealed, Supply Air, rectangular, duct insulation shall be the following:
 - 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density with factory FSK jacket.
- C. Concealed, Neutral Air, round and rectangular, duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2-1/8 inches thick and 0.75-lb/cu. ft. nominal density with factory FSK jacket.
- D. Concealed, Return Air, round and rectangular, duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2-1/8 inches thick and 0.75-lb/cu. ft. nominal density with factory FSK jacket.
- E. Exposed, Supply Air, round, duct insulation shall be the following:
 - 1. Double-Wall Spiral Duct with Mineral-Fiber Blanket Core: 1 thick and 1-lb/cu. ft. nominal density.
- F. Exposed, Supply/Neutral/Return Air, rectangular, duct insulation shall be the following:
 - 1. Mineral-Fiber Board: 1 inches thick and 6-lb/cu. ft. nominal density with factory ASJ jacket.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.11 PIPING INSULATION SCHEDULE

- A. Condensate Water:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Color: Black.

B. Refrigerant Suction, Liquid, and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Color: Black.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Exposed:
 1. PVC: 30 mils thick.

END OF SECTION 230700

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

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 control equipment for HVAC systems and components.

1.3 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds
 - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
 - 7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
 - 8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F .
 - b. Space Temperature: Plus or minus 0.5 deg F.
 - c. Ducted Air Temperature: Plus or minus 1 deg F.
 - d. Outside Air Temperature: Plus or minus 1 deg F.
 - e. Dew Point Temperature: Plus or minus 1 deg F.
 - f. Relative Humidity: Plus or minus 2 percent.
 - g. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - h. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - 9. Countdown Timers: Countdown timers shall be indicated on graphical user interface for any active delay timer used within the control sequence.
 - 10. Sequence Testing Override: A Sequence Testing Override setting shall be provided and accessible to authorized users via password. When enabled, this setting shall cause all input variables to the BAS to be user adjustable. This will allow the Owner to verify and test operation and sequence of equipment. Upon 30 minutes of inactivity, the system shall revert back to normal operational mode.
 - 11. Humidity and temperature trending data shall be available for each of the four lab areas. Data collection rates shall be configurable but shall be initially set to record data once

every hour. Sufficient trending data storage shall be provided to allow for a full year's worth of data storage based on initial data sampling rate.

12. User Interface: User interface graphics shall be based on control schematics and plans provided within these bid documents. User interface graphics shall be submitted to the Owner for approval prior to implementation.
13. Control Points: All control points shown on Schematic Control Diagrams Drawings as well as all other control points necessary to provide the sequence of operation shall be incorporated into the graphics. Setpoints and reset schedules shall be adjustable.

1.4 NETWORK ARCHITECTURE

- A. Connection to the State's network shall be through a single switch.
- B. All network switches and user PCs will be provided by ITSD.
- C. Network switches to be installed in locations approved by ITSD.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings:
 1. Graphical User Display image. Display shall be based on control diagrams and floor plans included with the Drawings.
 2. Contractor shall provide a list of all equipment to be connected to the State's network. Contractor shall also submit equipment data sheets for each.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with existing Fire Alarm System to achieve compatibility with equipment that interfaces with that system.
- C. If a PC or network switch is needed, construction schedules shall allow at minimum a 3 week lead time for the purchase and delivery of PCs and 45-60 day lead time for network switches provided by ITSD.
- D. All BacNet IP devices will be issued an owner provided IP address and need to be wired back to the state's network switch. No unmanaged network switches are permitted to be connected to the state's network.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.2 DDC EQUIPMENT

- A. General
 - 1. The Building Automation System (BAS) shall consist of a Network Server/Controllers (NSC) and a family of Standalone Digital Control Units (SDCUs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility.
 - 2. BAS user interface shall be web-based and the control system server shall be accessed using a web browser over the control system network and the State's local area network.
 - 3. No JAVA shall be required to access and view the control system.
 - 4. Systems shall use BACnet communication protocol.
 - 5. BAS devices with wireless access points will not be permitted.
 - 6. Shall be compatible with current Windows version or N-1.
 - 7. All network enabled BAS devices must be IPv4 capable.
 - 8. BAS devices must use wired media in the form of CAT5 or fiber to connect to the State network. No wireless connectivity is permissible.
 - 9. The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP protocol.
- B. Acceptable Manufacturers:
 - 1. Schneider Electric
 - 2. Siemens
 - 3. Johnson Controls

4. Honeywell

C. A sub-network of SDCUs using the BACnet IP protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers. All SDCU field controllers shall reside on their own private IP based network and shall communicate back to the NSC. SDCUs shall not require Owner provided IP addresses.

D. Application Software:

1. System security for each operator via software password and access levels.
2. Automatic system diagnostics; monitor system and report failures.
3. Database creation and support.
4. Automatic and manual database save and restore.
5. Dynamic color graphic displays with up to 10 screen displays at once.
6. Custom graphics generation and graphics library of HVAC equipment and symbols.
7. Alarm processing, messages, printing, and reactions.
8. Trend logs retrievable in spreadsheets and database programs.
9. Alarm and event processing.
10. Object and property status and control.
11. Automatic restart of field equipment on restoration of power.
12. Data collection, report printing, and logs. Include standard reports for the following:
 - a. Current values of all objects.
 - b. Current alarm summary.
 - c. Override summary
 - d. Disabled objects.
 - e. Alarm lockout objects.
 - f. Logs.
13. Custom report development.
14. Workstation application editors for controllers and schedules.
15. Maintenance management.

E. Custom Application Software:

1. English language oriented.
2. Full-screen character editor/programming environment.
3. Allow development of independently executing program modules with debugging/simulation capability.
4. Support conditional statements.
5. Support floating-point arithmetic with mathematic functions.
6. Contains predefined time variables.

2.3 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. RTDs and Transmitters:

1. Accuracy: Plus or minus 0.2 percent at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

4. Averaging Elements in Ducts: 24 inches long, rigid use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; adjust length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches
6. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight and precipitation. May be combined with outside air humidity sensor in a common protective enclosure.

C. Humidity Sensors: Bulk polymer sensor element.

1. Accuracy: 2 percent full range with linear output.
2. Outside-Air Sensor: 10 to 90 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F. May be combined with outside air temperature sensor in a common protective enclosure.
3. Indoor-Air Sensor: 20 to 80 percent relative humidity range at a temperature range of 50 to 95 deg F.

2.4 STATUS SENSORS

- A. Status Inputs for Fans: Airflow paddle switch with pilot-duty rating, adjustable range, and suitable for air velocities up 2,000 FPM.
- B. Occupancy Sensors: Ceiling mount, dual technology 360° sensor capable of detecting small motion (hand movements) in a 12 ft radial pattern when mounted 9 ft above the floor.

2.5 ACTUATORS

- A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 2. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 3. Coupling: V-bolt and V-shaped, toothed cradle.
 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 6. Power Requirements (Two-Position Spring Return): 24-V ac.
 7. Temperature Rating: Minus 22 to plus 122 deg F.
- B. CABLE
 1. Communication Cable
 - a. 18 AWG stranded conductor, with aluminum foil shielding, stranded tinned copper drain wire, and covered with a white PVC plenum rated jacket.
 2. Signal Cable

- a. 18 AWG stranded conductor, with aluminum foil shielding, stranded tinned copper drain wire, and covered with a white PVC plenum rated jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of exposed control sensors with Drawings and room details before installation. Utilize same location of previous devices where possible.
 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
- B. Install exposed cable in raceway.
- C. Install cables within conduit or on hooks in all other places. Cables shall run perpendicular to building framing.
- D. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
- E. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
- F. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- G. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- H. Connect manual-reset limit controls independent of manual-control switch positions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.

3. Test each point through its full operating range to verify that safety and operating control set points are as required.
4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
5. Test each system for compliance with sequence of operation.
6. Test software and hardware interlocks.

B. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check DDC system as follows:
 - a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - b. Verify that spare I/O capacity has been provided.
 - c. Verify that DDC controllers are protected from power supply surges.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:

- a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
- 7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
- 8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
- 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.

3.5 DEMONSTRATION

- A. Demonstrate compliance of installed system with the provided sequence of operation to the Owner's personnel and train personnel to adjust, operate, and maintain HVAC instrumentation and controls.

END OF SECTION 230900

SECTION 232301 – VRV/VRF REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for VRV/VRF air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
 - 2. Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

1.3 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, valve arrangements and locations, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
- C. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and brazing of copper tubing should be used.

1.5 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube:
 - 1. Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.
 - 2. Coiled: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped
- B. Brazing Filler Metals: AWS A5.8.
- C. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50
- D. Field Bends (all angles): ASME B31.5

2.2 VALVES AND SPECIALTIES

- A. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Socket ends.
 - 5. Working Pressure Rating: 700 psig.
 - 6. Maximum Operating Temperature 250 deg. F
 - 7. Valves must be specifically rated for R-410A.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction (low pressure gas), Hot Gas (high pressure gas) and Liquid Lines OD 5/8" and Smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with brazed joints.
- B. Suction (low pressure gas), Hot Gas (high pressure gas), and Liquid Lines OD 2-1/8" and smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves as shown on plans or as required to isolate system components.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss,

expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Field Bend changes in direction.
- I. Select system components with pressure rating equal to or greater than maximum allowable working pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- L. Provide Jacketed insulation in locations where exposed to mechanical injury.
- M. When brazing, remove solenoid-valve coils and sight glasses; also, remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.4 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
- B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015" brazing gap and a maximum of 0.005" brazing gap. Brazing cup depth for each tube size shall be as follows.

1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"	2-1/8"
0.250"	0.280"	0.310"	0.390"	0.420"	0.460"	0.510"	0.560"	0.600"	0.700"

- C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. BRAZING AND JOINING PROCEDURE

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.
4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
5. Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.
6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
7. Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
8. Post Brazing Cleaning: Exterior of all completed joints shall be washed with a water soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "230529 - Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs.
 2. Rigid high compressive strength foam insulating pipe support at all support points.
 3. Do NOT attach hangers directly to pipe or tube.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
 2. Greater than 3/4" thru 1" OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 3. Greater than 1" thru 2-1/8" OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test as recommended by equipment manufacturers instructions.
3. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - a. Fill system with 95/5 nitrogen/hydrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test all joints and fittings with hydrogen leak detector, at test pressure.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturers instructions.

1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system as recommended by equipment manufacturer.

END OF SECTION 232301

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1. Static-Pressure Classes:

- a. Supply Ducts (except in Mechanical Rooms): 1-inch wg.
- b. Return Ducts (Negative Pressure): 1-inch wg.
- c. Exhaust Ducts (Negative Pressure): 1-inch wg.

2. Leakage Class:

- a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at 1-inch wg.
- b. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg .

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.3 SUBMITTALS

A. Duct Design Submittal:

1. Sheet metal thicknesses.

2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – “Systems and Equipment” and Section 7 – “Construction and System Start-up.”
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 – “HVAC System Construction and Insulation.”

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.

- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 SEAM AND JOINT SEALING

- A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum

Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

- 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: High efficiency takeoff with gasket.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals."
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Control dampers.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

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

- a. Air Balance Inc.; a division of Mestek, Inc.
- b. American Warming and Ventilating; a division of Mestek, Inc.
- c. Flexmaster U.S.A., Inc.
- d. McGill AirFlow LLC.
- e. METALAIRE, Inc.
- f. Nailor Industries Inc.
- g. Pottorff; a division of PCI Industries, Inc.
- h. Ruskin Company.
- i. Trox USA Inc.
- j. Vent Products Company, Inc.

B. Standard, Steel, Manual Volume Dampers:

- 1. Standard leakage rating.
- 2. Suitable for horizontal or vertical applications.
- 3. Frames:
 - a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
- 5. Blade Axles: Galvanized steel.
- 6. Bearings:
 - a. Synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 7. Tie Bars and Brackets: Galvanized steel.

C. Damper Hardware:

- 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
- 2. Include center hole to suit damper operating-rod size.
- 3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

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

- 1. American Warming and Ventilating; a division of Mestek, Inc.
- 2. Greenheck Fan Corporation.
- 3. Nailor Industries Inc.
- 4. NCA Manufacturing, Inc.

5. Ruskin Company.
 6. Vent Products Company, Inc.
- B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
 2. Galvanized-steel channels, 0.064 inch thick.
 3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 8 inches.
 2. Opposed-blade design.
 3. Galvanized steel.
 4. 0.064 inch thick.
 5. Blade Edging: Closed-cell neoprene edging.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch-diameter; galvanized steel blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
1. Synthetic.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.4 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.8 FLEXIBLE DUCTS

- A. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F.
- B. Flexible Duct Connectors:
 1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 2. At maximum 50-foot spacing.
 3. Upstream of turning vanes.
 4. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes: (install the largest size below based on the ductwork size)
1. Hand Access: 6 by 10 inches.
 2. Head and Hand Access: 12 by 12 inches.
 3. Head and Shoulders Access: 18 by 18 inches.
- J. Install flexible connectors to connect ducts to equipment with an airflow over 2000 cfm.
- K. Connect diffusers to low-pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- L. Install duct test holes where required for testing and balancing purposes.

END OF SECTION 233300

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Nailor Industries of Texas Inc.
 - 2. Price Industries.
 - 3. Titus.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237200 - AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged Energy Recovery Units with Cross-Flow, Fixed-Core Air-To-Air Heat Exchangers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, furnished specialties, and accessories.
- B. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ARI Compliance: Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Rating Air-to-Air Energy Recovery Equipment."

1.4 COORDINATION

- A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PACKAGED ENERGY RECOVERY UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Daikin Industries, LTD.
 - 2. RenewAire LLC.
 - 3. Venmar CES Inc.
 - 4. LG Electronics

2.2 UNIT CASING

- A. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

1. Cold metal surfaces to be externally insulated.
2. Horizontal duct connections at each end.

2.3 FILTERS

- A. Two washable mesh filters at the outdoor air and return air inlets.

2.4 FANS AND MOTORS

- A. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
 1. Fans shall be capable of providing three, adjustable, fan speed settings.

2.5 AIR-TO-AIR HEAT EXCHANGER

- A. Cross-flow, fixed-core, air-to-air heat exchanger constructed of non-flammable, specially processed paper or metal to allow transfer of heat and humidity without mixing of the airstreams.
 1. An access panel shall be provided to facilitate removal of the cross-flow, fixed-core, air-to-air heat exchanger for cleaning purposes.

2.6 UNIT CONTROLS

- A. Basic Unit Controls:
 1. Unit-mounted microprocessor-based controller.
 - a. Functions:
 - 1) Auto restart following power restoration.
 - 2) External static pressure control for fans.
 - 3) Energy recovery mode: allows air to pass through air-to-air heat exchanger.
 - 4) Bypass mode: allows exhaust air to bypass the air-to-air heat exchanger.
 2. All operating parameters shall be internally stored in non-volatile memory backup on the unit-mounted microprocessor-based controller.
 - a. Exception: unit operating schedule.
 3. Dampers:
 - a. When the energy recovery unit is enabled to run in either occupied or unoccupied mode, the energy recovery unit shall send a 24V output to the outdoor air and exhaust air control dampers to open.
- B. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and spring hangers.
- B. Install units with clearances for service and maintenance.
- C. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 237200

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 238200 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A Variable refrigerant volume HVAC system includes:

1. Outdoor/condensing unit(s).
2. Indoor/evaporator units.
3. Branch selector units.
4. Refrigerant piping.
5. Control panels.
6. Control wiring.

1.2 RELATED REQUIREMENTS

A Section 232300 - Refrigerant Piping: Additional requirements for refrigerant piping system.

1.3 REFERENCE STANDARDS

- A AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:
 1. Outdoor/Central Units:

- a. Refrigerant Type and Size of Charge.
- b. Cooling Capacity: Btu/h (W).
- c. Heating Capacity: Btu/h (W).
- d. Cooling Input Power: Btu/h (kW).
- e. Heating Input Power: Btu/h (kW).
- f. Operating Temperature Range, Cooling and Heating.
- g. Air Flow: Cubic feet per minute (Cubic meters per second).
- h. Fan Curves.
- i. External Static Pressure (ESP): Inches WG (Pa).
- j. Sound Pressure Level: dB(A).
- k. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP (W).
- l. Weight and Dimensions.
- m. Maximum number of indoor units that can be served.
- n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.
- o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.
- p. Control Options.
- 2. Indoor/Evaporator Units:
 - a. Cooling Capacity: Btu/h (W).
 - b. Heating Capacity: Btu/h (W).

- c. Cooling Input Power: Btu/h (kW).
- d. Heating Input Power: Btu/h (kW).
- e. Air Flow: Cubic feet per minute (Cubic meters per second).
- f. Fan Curves.
- g. External Static Pressure (ESP): Inches WG (Pa).
- h. Sound Pressure level: dB(A).
- i. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP (W).
- j. Maximum Lift of Built-in Condensate Pump.
- k. Weight and Dimensions.
- l. Control Options.
- 3. Control Panels: Complete description of options, control points, zones/groups.

B Operating and Maintenance Data:

- 1. Manufacturer's complete standard instructions for each unit of equipment and control panel.

C Warranty: Executed warranty, made out in Owner's name.

1.5 QUALITY ASSURANCE

A Manufacturer Qualifications:

- 1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.

B Installer Qualifications: Trained and approved by manufacturer of equipment.

1.6 DELIVERY, STORAGE AND HANDLING

- A Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.7 WARRANTY

- A Provide equipment with minimum one-year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carrier Corporation; a member of the United Technologies Corporation Family.
 - b. Daikin Applied.
 - c. LG Electronics

2.2 HVAC SYSTEM DESIGN

- A System Operation: Heating and cooling, simultaneously.
 - 1. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
 - a. Exception: Where indicated, multiple indoor/evaporator units may be controlled in groups.
 - 2. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
 - 3. Outdoor/Condenser unit locations are indicated on drawings.
 - 4. Indoor/Evaporator unit locations are indicated on drawings.
 - 5. Branch selector unit locations are ~~not~~ indicated on drawings.
 - 6. Required equipment unit capacities are indicated on drawings.
 - 7. Refrigerant piping sizes are not indicated on drawings.

8. Connect equipment to condensate piping ~~provided by others~~; condensate piping is indicated on drawings.

B Controls: Provide the following control interfaces:

1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.
2. One central remote control panel for entire system.
3. BACnet gateways sufficient to connect all units to building automation system; include wiring to gateways.

C Local Controllers: Wall-mounted, wired, containing temperature and relative humidity sensing.

2.3 EQUIPMENT

A All Units: Factory assembled, wired, and piped and factory tested for function and safety.

1. Refrigerant: R-410A.
2. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
3. Provide units capable of serving the zones indicated.

B System Controls:

1. Include self diagnostic, auto-check functions to detect malfunctions and display the type and location.

C Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.

1. Provide interfaces to remote control and building automation systems as specified.
2. Outside air capability.

D Wiring:

1. Control Wiring: As specified by VRF equipment manufacturer.

E Refrigerant Piping:

1. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance.
2. Insulate each refrigerant line individually between the condensing and indoor units.

2.4 OUTDOOR/CONDENSING UNITS

- A Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
1. Refrigeration Circuit: Variable capacity compressor system, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil management system, service ports and refrigerant regulator.
 2. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
 3. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source.
 4. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
 5. Provide refrigerant auto-charging feature and refrigerant charge check function.
 6. Provide refrigerant auto-charging feature.
 7. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
 8. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to indoor units.
- B Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
1. Designed to allow side-by-side installation with minimum spacing.
- C Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
- D Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond.
- E Compressors: Variable capacity system, hermetically sealed:
1. Variable Capacity Control: Capable of changing the capacity to follow the variations in total cooling and heating load as determined by the suction gas pressure; with compressor capacity adjusted to eliminate deviation from target value.

2. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost.
3. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
4. Provide each compressor with, high pressure safety switch, and internal thermal overload protector.
5. Provide intelligent oil management system.
6. Provide vibration isolators.

2.5 BRANCH SELECTOR UNITS

- A Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves or solenoids, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
1. Control direction of refrigerant flow.
 2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected.
 3. Casing: Galvanized steel sheet.
 4. Refrigerant Connections: Braze type.
 5. Condensate Drainage: Provide condensate drainage if required by equipment manufacturer.

2.6 INDOOR/EVAPORATOR UNITS

- A All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, control circuit board, factory wiring and piping.
1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
 2. Temperature Control Mechanism: Return air thermistor.
 3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins; factory tested.
 - a. Flare connections to refrigerant piping.

- b. Provide thermistor on liquid and gas lines.
- 4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
- 5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
- 6. Condensate Drainage: Built-in condensate drain pan with drain connection.
 - a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff.
- 7. Cabinet Insulation: Provide equipment with insulated cabinets.
- B Recessed Ceiling Units: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling or lay-in ceiling.
 - 1. Exposed Housing: White, impact resistant, with washable decoration panel.
 - 2. Supply Airflow Adjustment:
 - a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
 - 3. Return Air Filter: Manufacturer's standard.
 - 4. Minimum Capacity: As indicated on drawings.
 - 5. Fan: Direct-drive.
 - 6. Condensate Pump: Built-in.
- C Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
 - 1. Return Air Filter: Manufacturer's standard.
 - 2. Provide adjustable external static pressure switch.
 - 3. Condensate Pump: Built-in.
 - 4. Switch box accessible from side or bottom.
- D Wall Surface-Mounted Units: Finished white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.
 - 1. Airflow Control: Auto-swing louver that closes automatically when unit stops; upon restart, discharge angle defaulting to same angle as previous operation.
 - 2. Condensate Pump: Built-in or externally mounted.

3. Condensate Drain Connection: Back, with piping concealed in wall.
4. Fan: Direct-drive.

PART 3 EXECUTION

3.1 EXAMINATION

- A Verify that required electrical services have been installed and are in the proper locations prior to starting installation.
- B Verify that condensate piping has been installed and is in the proper location prior to starting installation.
- C Notify Engineer if conditions for installation are unsatisfactory.

3.2 INSTALLATION

- A Install in accordance with manufacturer's instructions.
- B Install refrigerant piping in accordance with equipment manufacturer's instructions.
- C Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- D Coordinate with installers of systems and equipment connecting to this system.

3.3 FIELD QUALITY CONTROL

- A Provide manufacturer's field representative to inspect installation prior to startup.

3.4 SYSTEM STARTUP

- A Provide manufacturer's field representative to perform system startup.
- B Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
- C Adjust equipment for proper operation within manufacturer's published tolerances.

3.5 CLEANING

- A Clean exposed components of dirt, finger marks, and other disfigurements.

3.6 CLOSEOUT ACTIVITIES

- A Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.

3.7 PROTECTION

- A Protect installed components from subsequent construction operations.
- B Replace exposed components broken or otherwise damaged beyond repair.

END OF SECTION 238200

SECTION 238216 - AIR COILS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes electric air coils that are not an integral part of air-handling units.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 ELECTRIC COILS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. INDEECO.
 - 2. Warren Technology, Inc.
 - 3. Greenheck
- B. Coil Assembly: Comply with UL 1995.
- C. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets.
- D. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.
 - 1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
- E. Frames: Galvanized-steel channel frame for slip-in mounting.
- F. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
 - 1. Magnetic contactor.

2. SCR controller.
 3. Time-delay relay.
 4. Airflow proving switch.
- G. Thermostats: Duct-mounted thermostats, with temperature range from 0 to 90 deg F, and 2.5 deg F throttling range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- C. Straighten bent fins on air coils.
- D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.
- E. Ground equipment according to Division 26 Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 238216

SECTION 239100 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed louvers, frames and accessories.
- B. Related Sections:
 - 1. Section 233100 - HVAC Ducts and Casings: Ductwork attachment to louver.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500- L - Test Methods for Louvers, Dampers, and Shutters.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
- B. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.
- B. Perform Work in accordance with specified building codes and manufacturer standards.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 WALL LOUVERS - DRAINABLE STYLE

- A. Manufacturers:
 - 1. Greenheck Fan Corporation
 - 2. Ruskin Company
 - 3. United Enertech

- B. Furnish materials in accordance with specified building codes and manufacturer standards.
- C. Louver Construction: Aluminum.
- D. Louver Panel Thickness: as indicated on Drawings.
- E. Louver Blade Design: Sloped at 45 degrees; dual drain style.
- F. Louver: To permit 50 percent free area.
- G. Water Penetration: Not more than 0.01 oz/sq ft of free area at minimum 500 ft / min face velocity.

2.2 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Primer: Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frame.

2.3 FABRICATION

- A. Screens: Install screen mesh in shaped frame, reinforce corner construction.

2.4 FACTORY FINISHING

- A. Exterior Aluminum Surfaces, Screen and Blank-Out Sheeting: Mill finish. Coordinate color with Architect.
- B. Interior Aluminum Surfaces and Blank Out Sheeting: Unfinished.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install louvers level and plumb.
- B. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- C. Install insect screen and frame to interior of louver.

3.3 CLEANING

- A. Clean surfaces and components.

END OF SECTION 239100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Product substitution process.
3. Common electrical installation requirements.

1.2 COORDINATION

- A.** Contractor must read the entire Specifications covering other branches of Work. Contractor is responsible for coordination of his (her) work with work performed by other trades.
- B.** Consult all Contract Documents which may affect the location of any equipment or apparatus furnished under this Work and make minor adjustments in location as necessary to secure coordination.
- C.** System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. Any major deviations from the proposed work because of conflict is to be reported to the Engineer/architect. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of Work.
- D.** Contractor shall contact the Owner's Representative immediately if he (she) notices any discrepancies or omissions in either the Drawings or Specifications, or if there are any questions regarding the meaning or intent thereof.
- E.** The Contractor is required to visit the site and fully familiarize himself or herself concerning all conditions affecting the scope of work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his or her Work.
- F.** All workmanship to be of the highest quality in accordance with the best practices of the trade by craftsmen/ craftswomen skilled in this particular work.
- G.** All buried conduits passing from below the proposed building to the exterior shall pass below the proposed structural footing.
- H.** Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- I.** Coordinate sleeve selection and application with selection and application of firestopping.

1.3 PERMITS, INSPECTIONS AND CODES

- A.** File all drawings, pay all fees, and obtain permits and certificate of inspection relative to this Work.

- B. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances including, but not limited to the latest approved editions of the following:
 - 1. State Building Codes.
 - 2. Specific Construction Safety Requirements, State Industrial Commission.
 - 3. National Electrical Code (NFPA-70).
 - 4. Life Safety Code, NFPA-101.
 - 5. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
- C. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances and they are hereby included in these specifications.

1.4 RECORD DRAWINGS

- A. Record all deviations from the Drawings, on a set of prints and deliver them to the Owner and Owner's Representative upon completion of the work. Special attention to record the location of concealed boxes, service runs shall be made at the point of installation to maintain accuracy.
 - 1. Sufficient dimensional tie points to permanent building features shall be provided for all buried conduits to facilitate future location.

1.5 INSPECTION

- A. Contractor shall arrange for and include in his (her) bid, inspection of this work by the appropriate stator or local code authority having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Furnish new, undeteriorated materials of a quality not less than what is specified.
- B. Contractor to furnish and install only those brands of equipment mentioned specifically or accepted as substitutes.

2.2 SUBSTITUTIONS

- A. Contractor must base his (her) bid on furnishing the brands of material and equipment listed in the Specifications or their approved equals.
- B. The Contractor is entitled to bid on any other equal or similar brands of material and equipment he (she) may desire to substitute. The Contractor shall submit the necessary literature to show the alternative product meets the performance characteristics of that which has been called for. In order to be considered, the Contractor must request approval to bid the substitution in writing no later than ten (10) days prior to the Bid Date. If permitted the substitutes will be approved by addendum.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying Drawings.
- B. Include any minor items of work necessary to provide a complete and fully operative electrical system which meets all required codes.
- C. Comply with NECA 1.
- D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- G. Right of Way: Give to piping systems installed at a required slope.

3.2 PROTECTION AND CLEANING

- A. Protect all fixtures and equipment against damage from leaks or abuse and pay the cost of repair or replacement of fixtures or equipment made necessary by failure to provide suitable safeguards or protection.
- B. After all fixtures and equipment have been set, thoroughly clean all fixtures and equipment with manufacturers recommended cleaning agents, removing stickers and other foreign matter and leave every part in acceptable condition, clean and ready for use.
- C. Repair all dents and scratches in factory prime or finish coats on all electrical equipment. If damage is excessive, replacement may be required.

END OF SECTION 260500

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 STANDARDS

- A. Insulation types, ratings and usage shall be in accordance with the National Electrical Code requirements.
- B. All conductors shall be copper
- C. Unless otherwise noted, minimum wire size for lighting and power branch circuits shall be No. 12 AWG. For control and auxiliary systems the minimum size shall be No. 14 AWG.
- D. Conductors for emergency power and exit wiring shall be a minimum No. 12 AWG.

2.2 CONDUCTORS AND CABLES

- A. All wire and cable shall be UL listed.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, and SO.
 - 1. THHN-THWN- 90 degree C temperature rating in dry or wet locations.

- D. Multiconductor Cable: Comply with NEMA WC 70 for metal clad cable, Type MC and Type SO with ground wire.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- B. All components used at wiring terminations, connections and splices shall be UL listed.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway or Type XHHW, single conductors in raceway.
- B. Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.
- C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- D. Concealed light fixture whips: Metal clad cable (Type MC) limited to six feet in length.
- E. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- F. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION 260519

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
- B. Grounding system shall be in compliance with all requirements of the National Electrical Code.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 inch in diameter by 10 feet or as noted on the Drawings.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned copper conductor. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
- D. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. A separate equipment grounding conductor, minimum size per NEC, shall be installed in each feeder, branch circuit, and control circuit conduit. Conductor insulation shall be green. DO NOT use conduit as a means for grounding of receptacles or any other such devices.
- B. Conduit system shall be electrically continuous. All enclosures and non-current carrying metals to be grounded. All locknuts must cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps.
- C. All new receptacles shall be bonded to a ground conductor using a #12 AEG min. bonding jumper between receptacle terminal and ground conductor. Metal-to-metal contact between the device yoke and the outlet box is not acceptable for either surface mounted boxes or flush type boxes.
- D. Junction boxes and pull boxes shall be bonded by the use of UL listed ground screws or lugs.

- E. Lighting fixtures shall be grounded by the use of a pigtail fastened on bare metal that is free of paint.
- F. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- G. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- I. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using

- one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Aluminum Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 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:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

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

END OF SECTION 260529

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

- A. Product Data: For surface raceways and floor boxes.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. EMT: ANSI C80.3.
- C. FMC: Zinc-coated steel.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Steel, set-screw or compression type. Die cast fittings are not acceptable.
- F. LFMC: Flexible steel conduit with PVC jacket. Made from a continuous length of galvanized cold rolled steel strip, spirally wound. Adjacent strips shall have locked typed construction with all the edges turned in. With an extruded PVC jacket.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. PVC conduit shall be heavy wall, Schedule 40 ultra-violet resistant, UL listed under Standard 651. Conduit shall be suitable for use with 90 degree C insulated wire. Conduit fittings and cement shall be of the same manufacturer.

- B. Fittings for Schedule 40 PVC: Match to conduit or tubing type and material.

2.3 BOXES AND ENCLOSURES

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1,
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
 - 1. Color of Frame and Cover: Green.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE.", "COMMUNICATIONS as appropriate for services contained.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.5 SLEEVES FOR RACEWAYS

- A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid Steel Conduit.
 - 2. Concealed Conduit: EMT.
 - 3. Underground Conduit: Schedule 40 PVC, direct buried.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. All other exposed areas: RMC.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC
 5. Damp or Wet Locations: RMC.
 6. Raceways for Optical Fiber or Communications Cable: EMT.
 7. Boxes and Enclosures: NEMA 250, Type 1, except as noted on the Drawings.
- C. Minimum Raceway Size: 3/4-inch trade size Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. In finished areas, conduit must be concealed above accessible ceilings, within the building structure, or within chases. Exposed conduits to be run tight to wall or ceiling and installed in a neat workmanlike manner, ready for painting.
- C. Install conduit parallel or perpendicular to building lines (except where run in or below floor slabs). Keep conduit runs as closed to underside of structure as possible.
- D. Exercise necessary precautions to prevent accumulation of water, dirt, or concrete in conduits during execution of electrical work. Conduit in which water or foreign material has been permitted to accumulate shall be thoroughly cleaned, or replaced where such accumulations cannot be removed.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- J. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from ENT rigid steel conduit before rising above the floor.
- K. Raceways below slabs:
1. Minimum conduit size shall be 1".
 2. Change from PVC conduit to rigid steel conduit before rising above floor.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 240-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- N. Raceways for Optical Fiber and Communications Cable: Install as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- P. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Metal boxes cast in concrete shall be designed for concrete installation.
- S. Weather-proof boxes shall be die cast aluminum.
- T. Boxes for exposed work in finished area to be Type FS with threaded hubs and rigid conduit risers.
- U. Install expansion fittings at all locations where conduits cross building expansion joints.
- V. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.

- W. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers or unistrut racks tight to the building structure.
- X. Mount junction and pull boxes securely to building structure in a location that meets the requirements of the National Electrical Code for accessibility and work space clearance. Coordinate exact locations of work with other trades. Unless noted otherwise, mounting heights shall be (all measurements are to the top of the box):

Switches, receptacles, or telephone/data shown above a countertop	12" above countertop
Dedicated receptacles (i.e. refrigerator, microwave, etc.)	To suit equipment (see equipment/cabinetry elevation drawings where applicable)
Other interior receptacles	16" AFF
Exterior receptacles	20" above finished grade
Other switches	48" AFF
Telephone/data shown next to a doorway	56" AFF
Other telephone/data	16" AFF

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit (not concrete encased):

1. Install direct buried conduit according to Division 31 requirements for conduit installation.
2. Absent Division 31 requirements or if the following is more stringent, install direct buried conduit as follows:
 - a. Excavate by open cut unless otherwise directed on the Drawings.
 - b. Excavate to the depths necessary to provide at least the NEC required minimum burial depths upon project completion.
 - c. Over-excavate organic, soft, spongy, or otherwise unsuitable soils found at or below the bottom of the trench to meet firm subsoil.
 - d. Trenches in non-pavement and non structure areas:
 - 1) After installing conduit, backfill and compact utilizing native backfill material. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction leaving a mound on the surface to accommodate future settling.
 - e. Trenches under pavement or structures and within 5'-0" of same:
 - 1) After installing conduit, backfill with compacted aggregate to 95% standard proctor density in 8" maximum lifts. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling.

3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
4. Warning Planks: Bury warning tape approximately 12 inches above direct-buried conduits.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- D. Cut sleeves to length for mounting flush with both surfaces of walls.
- E. Extend sleeves installed in floors 2 inches above finished floor level.
- F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- H. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- I. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

END OF SECTION 260533

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Data/Telephone outlet labels
 - 3. Receptacle labels
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.145.

1.3 COORDINATION

- A. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 DATA/TELEPHONE OUTLET LABELS

- A. Machine printed paper insert with black filled lettering located under clear label cover on face of plate and durable wire markers on inside of outlet box.

2.3 RECEPTACLE LABELS

- A. Hot stamped or engraved machine printing with black filled lettering on face of plate and durable wire markers on inside of outlet box.

2.4 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.5 WARNING LABELS AND SIGNS

- A. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- B. Color Scheme
 - 1. Emergency Warning labels: White background with red letters
 - 2. All other warning labels: Yellow background with black letters
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
 - 3. Junction boxes containing emergency circuits: "EMERGENCY CIRCUITS- PANEL *insert name*"
 - 4. As noted on drawings.

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face. (White letters on red background for emergency information)
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for fasteners, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Fasteners for Labels: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- B. Covers for all junction boxes containing emergency circuits shall be red.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 - 2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Data/Telephone Outlet Identification: Use outlet labels to identify each outlet connection. Use system of designation that is uniform and consistent with cable identification. Label face of plate and wire markers inside of box,
- C. Receptacle Identification: Use labels to identify panelboard and circuit number from which served. Label face of plate and wire markers inside of box,
- D. Locations of Underground Lines: Identify with underground-line warning tape for power and lighting wiring. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- F. Instruction Signs:
 - 1. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for emergency shut down of generator or remote operation of main switch.
- G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels

to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Indoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
- c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

- a. Panelboards, electrical cabinets, and enclosures.
- b. Transformers.
- c. Generators
- d. Disconnect switches.
- e. Fire alarm control panel and annunciators
- f. Motor control switches including Hand/Off/Auto switches

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.
 1. Color shall be factory applied or for sizes larger than No. 10 AWG field applied
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

END OF SECTION 260553

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:

1. Outdoor photoelectric switches.
2. Indoor occupancy sensors.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each lighting switching schematic shown in the Drawings, provide a separate wiring diagram with wire types, quantities, and devices necessary to provide the functionality indicated on the drawings. Generic wiring diagrams will not be acceptable.
- C. Operation and Maintenance Data: Provide (3) hard copies in separate 3-ring binders and an electronic copy. Include the following:
1. Operating Instructions
 2. Wiring diagrams
 3. As-built settings

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 3. Intermatic, Inc.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Novitas, Inc.
 6. Square D; Schneider Electric.
 7. TORK.
 8. Watt Stopper (The).

- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Novitas, Inc.
 4. RAB Lighting, Inc.
 5. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: See schedule on Drawings.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.
- B. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.14 AWG.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions

3.2 WIRING INSTALLATION

- A. Minimum Conduit Size: Shall be 1/2 inch.
- B. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 260923

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Comply with NECA 1.

1.4 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Finishes:
 - a. Panels and Trim: Steel and galvanized steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - 5. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
 - 1. Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs (When required): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs (When required): Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

- E. Service Equipment Label (When applicable): NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Mains: Circuit breaker or main lugs only as noted on Drawings.
- E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.

- b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
- c. Shunt Trip (When indicated): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
- d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- e. Handle Padlocking Device (When indicated): Fixed attachment, for locking circuit-breaker handle in on or off position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount top of trim 90 inches Insert height above finished floor unless otherwise required keep the distance from the floor to top most circuit breaker within the height limitation contained in the NEC.
- B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- C. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Recessed panels: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components.
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5352 (duplex).

- b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; TRBR20.
 - b. Hubbell; BR20TR.
 - c. Leviton; TCR20
- C. Quadruplex Receptacles, 125V, 20A: Straight blade, Screw mount body, Black cover, 2-Pole, 3-Wire with break-off tabs for split circuiting. Comply with NEMA WD 1, NEMA WD 6, and UL498. NEMA 5-20R rated.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; 21254.
 - b. Leviton; 21254.
 - c. Pass & Seymour; 420.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.
 - c. Leviton; AGTR1.

2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

- c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Motor Disconnect Switches: Voltage, HP, poles, and operation to suit load served.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Thermoplastic nylon, white
 - 3. Material for Unfinished Spaces: Thermoplastic Nylon or Galvanized steel.
- B. Wet-Location, Weatherproof Enclosures: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.6 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 RECEPTACLE APPLICATION

- A. Where required by the most recent version of the NEC and as indicated on the plan sheets: GFCI receptacles
- B. Where not noted on the Drawings: Standard receptacles

3.2 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.3 IDENTIFICATION

- A. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION 262726

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Enclosures.

1.2 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with NECA 1.
- D. Comply with NEMA PB 1 and 2.

1.4 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors. (If required)

2.2 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. As noted in the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.3 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures.
 - 2. Exit signs.
 - 3. Lighting fixture supports.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. See lighting schedule on Drawings.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.

- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

2.3 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 80,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 265100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cabling.
 - 3. Telecommunications outlet/connectors.
 - 4. Cabling identification products.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - 1. Bridged taps and splices shall not be installed in the horizontal cabling.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: Where cable tray is not indicated, NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high and 2-1/2 inches deep.
 - 2. All fiber optic cable shall be routed in conduit.

2.2 UTP CABLE

- A. Description: 100-ohm, 4-pair UTP, covered with a thermoplastic jacket.
 - 1. Thermoplastic jacket color:
 - a. Data Outlets: Blue
 - b. Telephone Outlets: White
 - 2. Comply with ICEA S-90-661 for mechanical properties.
 - 3. Comply with TIA/EIA-568-B.1 for performance specifications.
 - 4. Comply with TIA/EIA-568-B.2, Category 6.
 - 5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Multipurpose: Type MP or MPG.

2.3 FIBER OPTIC CABLE

- A. 6-Strand, 50 micron multi-made cable

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks:
 - 1. Voice: Hubbell Xcelerator (PN: HXJ6W) CAT6 Keystone jack.
 - 2. Data: Hubbell Xcelerator (PN: HXJ6B) CAT6 Keystone jack.
- B. Workstation Outlets: Two-port-connector assemblies mounted in single faceplate.
 - 1. Plastic Faceplate: White, Hubbell (PN IFP12W)
- C. Network Cabinet: Black Box (PN RMT353LA)

1. 6U vertical lockable
2. Provide with two (2) 24-port patch panels. Hubbell (PN UDX24E).

2.5 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Cable will be considered defective if it does not pass tests and inspections.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables cable trays where provided. Install cables within conduit or on hooks in all other places. Cables shall run perpendicular to building framing. Conceal raceway and cables except in unfinished spaces.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- C. Where ceiling data outlets are shown in an area of accessible ceilings, provide cable to location indicated with at least ten extra feet of cable neatly coiled above ceiling. The cable shall be terminated and labeled but data outlets are not required.

3.2 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than **60 inches** apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 - 3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 - 4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 - 5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.
- G. Connection to Patch Panel:
- 1. Data Cable:
 - a. Terminated onto 24-port patch panel.
 - 2. Telephone Cable:
 - a. Terminated onto 24-port patch panel.

3.4 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- C. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. UTP Performance Tests:
 - a. Test for each outlet and. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.

10) Delay skew.

- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. Prepare test and inspection reports.

END OF SECTION 271500

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Smoke Detectors
 - 2. CO Detectors
 - 3. Relay Modules
 - 4. Manual fire-alarm boxes.
 - 5. Notification appliances.
 - 6. Wire and Cable.

1.2 SYSTEM DESCRIPTION

- A. Project generally consists of the following:
 - 1. New fire alarm devices in building additions.
 - 2. Connect new fire alarm devices to existing fire alarm control panel.
- B. The fire alarm equipment and installation shall comply with the current provisions of the following latest edition standards and shall be listed for it's intended purpose and be compatibility listed to insure integrity of the complete system.

1.3 BUILDING CODES and STANDARDS

- A. National Fire Protection Association (NFPA):
 - 1. NFPA-70 National Electrical Code (NEC)
 - 2. NFPA-72 National Fire Alarm Code
 - 3. NFPA 101 Life Safety Code
 - 4. IBC International Building Code
 - 5. IFC International Fire Code
 - 6. IMC International Mechanical Code
- B. National Electrical Manufacture's Association (NEMA)
- C. Underwriters Laboratories, Inc. (UL)
 - 1. UL-864 Control Units for Fire Protective Signaling Systems (9th Edition)
 - 2. UL-268 Smoke Detector for Fire Protective Signaling Systems
 - 3. UL-217 Smoke Detectors for Single and Multiple Station
 - 4. UL-521 Heat Detectors for Fire Protective Signaling Systems
 - 5. UL-464 Audible Signaling Appliances
 - 6. UL-1971 Visual Signaling Appliances
 - 7. UL-38 Manually Actuated Signaling Boxes
 - 8. UL-1481 Power Supplies for Fire Protective Signaling Systems
 - 9. UL 2017 Mass Notification Systems
 - 10. UL 2572 Control and Communication Units for Mass Notification Systems

1.4 SUBMITTALS

A. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:

- a. Trained and certified by manufacturer in fire-alarm system design.
- b. NICET-certified fire-alarm technician, Level II minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
3. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits from end-to-end. "Home Run" indicators or other non end-to-end wire path designations are not acceptable.

D. Field quality –control reports.

E. Operation and Maintenance Data: For fire-alarm systems and components.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling fire alarm system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and material installed as part of this project shall be completely compatible with the existing system and fully integrated with existing equipment.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Smoke detectors.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 5. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at fire-alarm control unit.
 - 4. Ground or a single break in fire-alarm control unit internal circuits.
 - 5. Abnormal ac voltage at fire-alarm control unit.
 - 6. Break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

- A. The existing fire alarm control unit shall be re-used.

2.4 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

6. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
7. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
8. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
9. Provide multiple levels of detection sensitivity for each sensor.
10. Device Replacement: The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

B. Intelligent Carbon Monoxide Detector

1. Provide Intelligent CO Sensor is an intelligent device that uses a CO sensor to detect carbon monoxide from any source of combustion and analyzes the sensor data to determine when to initiate a life safety CO alarm. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
2. The detector signals to the control panel when the CO sensor reaches its end of life. The CO element shall be field replaceable.
3. The CO Detector shall activate upon the following conditions:
 - a. 70 PPM for 60 – 240 minutes
 - b. 150 PPM 10- 50 minutes
 - c. 400 PPM 4 – 15 minutes
4. The CO activation shall be programmable type as follows: Alarm, Supervisory Latching, Supervisory Non-Latching, Monitor Latching, or Monitor Non-Latching.

2.5 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes:** Comply with UL38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. The manual pull station will have an intelligent module integral of the unit.
 3. Station Reset: key operated switch shall match the control panel key.
 4. Manual pull stations that initiated an alarm condition by opening the unit are not acceptable.

2.6 NOTIFICATION APPLIANCES

- A.** All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.

B. Notification Appliances – Visual

1. Provide clear lens strobes that provide a smooth light distribution pattern field selectable candela 15 cd, 30 cd, 75 cd, and 110 cd flash output rating, UL1971 listed with in-out screw terminals shall be provided for wiring. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting. All strobes shall be synchronization to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules. The strobes shall mount to one-gang electrical box.
2. High candela clear lens strobes that provide field selectable candela 95cd, 115cd, 150cd and 177cd flash output rating, UL1971 listed with in-out screw terminals shall be provided for wiring.

2.7 WIRE AND CABLE

- A. General: Cable jacket color shall be red.
- B. Signaling Line Circuits – Network Data: Twisted pair, not less than No. 18 AWG or as recommended by the manufacturer.
- C. Signaling Line Circuits – Intelligent Loop: Non-Twisted pair, not less than No. 16 AWG or as recommended by the manufacturer.
1. Circuit Integrity Cable: Provide as required to meet NFPA or Local Code requirements.
 2. CI Cable shall meet article 760, power limited fire alarm service.
- D. Notification Appliance Circuits –
1. Visual. Non-Twisted pair, not less than No. 12 AWG or as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 and NEC Article 760 for installation of fire-alarm equipment.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aggregate materials for fill, drainage, and grading purposes.
- B. Related Sections:
 - 1. Section 312300 – Excavation and Fill.
 - 2. Section 312333 - Trenching and Backfilling.
 - 3. Section 334100 - Storm Utility Drainage Piping.

1.2 SUBMITTALS

- A. Section 013300 - Submittals.
- B. Samples: Submit, in air-tight containers, 50 lb. sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Test reports: Submit gradation test results for all furnished materials.

1.3 REFERENCES

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12 inch Drop.
- C. ASTM D2487 - Classification of Soils for Engineering Purposes.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D6938 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with MoDOT Standard Specifications, current edition.

PART 2 - RODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Aggregate for Base Type 1 OR 5: MODOT Specification Section 1007
- B. Aggregate for Drainage Grade 1-4: MODOT Specification Section 1009
- C. Aggregate for Structural Systems: MODOT Specification Section 1010
- D. Washed Filter Stone: MODOT Specification Section 1009 Grade 2

2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate Type A6 (Sand): Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.3 SOURCE QUALITY CONTROL

- A. Section 014529 - Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D6938. ASTM D4318. ASTM C136.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D6938. ASTM D4318. ASTM C136.
- D. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- E. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 STOCKPILING

- A. Stockpile materials on site at locations designated by owner.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free-standing surface water.

END OF SECTION 310516

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees, shrubs, plants and grass to remain.
 - 2. Removing existing trees, shrubs, plants and grass.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting and capping or sealing site utilities.
 - 7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

- A. Except indicated items to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from or when applicable disposed in approved locations on the Owners property.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in 312300 Excavation and Fill.
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Missouri Department of Natural Resources Land Disturbance Permit.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect/Engineer.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect/Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect/Engineer's written permission.

3.5 CLEARING AND GRUBBING

- A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.
- B. Tree removal:
 - 1. Contractor shall remove the trees, including root balls.
 - 2. Contractor shall fill voids remaining following removal of the root balls with topsoil in non-pavement areas or structural fill in areas of proposed pavements.
- C. Protection of persons and property:
 - 1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.
 - 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.
 - 4. Provide traffic control items in accordance with the Manual of Uniform Traffic Control Devices (MUTCD), and the requirements of the governmental agency having jurisdiction, when work is being complete on or adjacent to public streets and/or Right-of-ways.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to a depth of 6-9 inches or to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.7 SITE IMPROVEMENTS

- A. Remove existing above and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Pavements to be removed adjacent to pavement or structures to remain shall be saw cut to provide a uniform edge.
- C. Below grade structures to be removed shall be removed to a minimum of three (3) feet below proposed grade unless in conflict with proposed improvements which may require full removal and disposal.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off site. Excess topsoil shall be deposited in another location on the ISTS campus in a location to be determined and approved by the Owner.
- B. Do not burn debris at the site.

END OF SECTION 311000

SECTION 312300 - EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Excavate, backfill, compact, and grade the site to the elevations shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents. Work includes topsoil stripping, topsoil stockpiling, excavation, preparation & compaction of subgrades for buildings, drives & walks, mass earthwork, topsoil respreading and erosion control.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Soils Report: A Geotechnical Investigation report, if completed, is attached for reference only.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Perform Field Quality Controls Testing as specified herein.
 - 2. Perform excavation and embankment work in compliance with applicable rules and regulations of DNR, MoDOT, and OSHA.
 - 3. Obtain any necessary permits for this section of work and pay any fees required for permits.
 - 4. The entire installation shall fully comply with all local and State laws and ordinances and with all established codes applicable thereto.
- B. Testing and Inspection:
 - 1. Cost of field and laboratory testing will be borne by the Owner. Lab reports shall be simultaneously forwarded to the Owner, Contractor & Engineer.
 - 2. Contractor shall cooperate with testing laboratory and geotechnical engineer in coordination of compaction tests.

1.3 REFERENCES

- A. Standard Specifications for Highway Construction, 2018, Missouri Department of Transportation, herein noted as the Standard Specifications.
- B. ASTM D698 Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures, Using 5.5 lb. Rammer and 12 inch Drop.
- C. ASTM D1556 Test Method for Density of Soil in Place by the Sand Cone Method.

- D. ASTM D2487 Classification of Soils for Engineering Purposes.
- E. ASTM D6938 Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

1.4 CONSTRUCTION STAKING AND SURVEYS

- A. General: From lines and levels established by property survey, and as shown in relation to the work, Contractor to establish and maintain bench marks, base lines, and other dependable markers to set lines and levels for the work.
- B. Owner Property Surveys: Owner reserves the rights to hire an independent Engineer to survey the site for compliance with the contract documents. The Contractor will be required to correct all work not in compliance with the plans and specifications.

1.5 JOB CONDITIONS

- A. Existing Utilities:
 - 1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during demolition operations.
 - 2. Underground utilities shown on the drawings have been taken from existing public records, Owner's records, and available as-built drawings and are indicated to the best of our knowledge and provided for information only.
 - 3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities caused by Contractor's negligence to the satisfaction of utility owner at not cost to the Project Owner.
 - 4. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
 - 5. Provide minimum of 48-hours notice to Owner and Engineer and receive written notice to proceed before interrupting any utility.
 - 6. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- B. Protection of Persons and Property:
 - 1. Barricade open excavations occurring as part of this work and post with warning lights.
 - 2. Operate warning lights as recommended by authorities having jurisdiction.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by demolition operations.
 - 4. Perform excavation within drip-line of large trees to remain by hand, and protect root system from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

- C. Contract Limits:

1. Contract limits are shown on the drawing:
 - a. Contractor will maintain his construction operations within the contract limits.
 - b. Disturbance or damage occurring outside of the contract limits as a result of the Contractor's operations will be repaired to the original condition at no expense to the Owner.

1.6 SUBMITTALS

- A. Samples: Submit, in air-tight containers, 50 lb. sample of each type of fill to testing laboratory.
- B. Materials Source: Submit name of imported materials source.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS/DEFINITIONS

- A. Satisfactory soil materials are defined as follows:
 1. Those complying with ASTM D2487 soil classification groups CL, GC, GW, CP, GM, ML, SC, SM, SW, and SP.
 2. Predominately granular or non-expansive soils, free from organic matter and deleterious substances, containing no rocks over 3" in greatest dimension and having a minimum Standard Proctor Density of not less than 100 lbs/cu ft.
 3. Material is subject to the approval of the A/E, and may be removed from onsite excavations or imported from off-site borrow areas.
 4. The upper 12" of fill or embankment shall not have rocks greater than 1" in dimension.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MG, CH, DH, OL, OH, PT, and any bedrock material.
- C. Fill Materials:
 1. The fill material type shall be cohesive, non-expansive soil having a "CL" or "CL-ML" classification in accordance with the Unified Soil Classification System and shall have a maximum laboratory dry density (100%) of 100 pounds per cubic foot or more as determined by ASTM D698 (Standard Proctor). Fill material placed beneath and within 10 feet structures or pavements shall have a liquid limit of less than 45% and a plasticity index of less than or equal to 25%
 2. No organic dark colored soils or plastic and potentially expansive soils, such as clay shale, are considered suitable engineered fill materials. Topsoil should be sorted and stockpiled for landscaping purposes.
 3. When fill material includes rock, the maximum rock size acceptable shall be three inches (3"). No large rocks shall be allowed to nest and all voids must be carefully filled with small stones or earth, properly compacted. No large rocks will be permitted within twelve inches (12") of the finished grade.

2.2 TOPSOIL

- A. Topsoil shall consist of friable, fertile soil of a loamy character. It shall be relatively free from large roots, sticks, weeds, brush, or stones larger than 1 inch in diameter, or other litter and waste products. At least 90 percent must pass the 2.00 mm (No. 10) sieve and the pH must be between 5.5 and 7.0.
- B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources.
- C. Re-spread stripped topsoil to a 6" minimum thick over all disturbed project areas designated as lawn/grass and to fill islands as shown. Use satisfactory soil materials meeting the requirements above.

2.3 GRANULAR FILL

- A. Material consisting of crushed stone reasonably well graded from 1" to no more than 20% passing the 200 sieve.
- B. Drainage Layers: Material consisting of clean crushed stone or gravel graded from 1" to no more than 5% passing the 200 sieve.

2.4 SOURCE QUALITY CONTROL

- A. Section 014529 – Testing Laboratory Services: Testing and Inspection Services Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698. ASTM D2167. ASTM D6938.
- C. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698. ASTM D2167. ASTM D6938.
- D. If tests indicate materials do not meet specified requirements, change material and retest. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

- A. Finish grading shall be to contours or elevations indicated on the drawings. Rocks and other debris unearthed during finish grading operations shall be removed from construction area and disposed of elsewhere.

- B. The Contractor shall provide field engineering services as required but not limited to:
1. Establish and maintain lines and levels.
 2. Structural design of shores, forms, and similar items as part of his/her means and methods of construction.

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
2. If active lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect/Engineer (A/E) to secure instructions from the Owner or his/her onsite representative.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Owner or his/her onsite representative.

B. Protection of persons and property:

1. Furnish, install and maintain barricades, warning lights, and/or warning tape at open holes and depressions or other potential hazards occurring as part of this Work.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.
4. Provide traffic control items in accordance with the Manual of Uniform Traffic Control Devices (MUTCD), and the requirements of the governmental agency having jurisdiction, when work is being complete on or adjacent to public streets and/or Right-of-ways.

C. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
2. Do not allow water to accumulate in excavations.
3. Remove all water, including rainwater, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
4. Keep excavations and site construction area free from water.

D. Storm Water Permit:

1. The project will result in disturbance of less than 1-acre of soil and will not require an NPDES permit.

- a. The Contractor shall be responsible for developing and implementing storm water pollution prevention measures in accordance with good engineering practice, as shown on the plans and in compliance with state and local regulations.

3.4 CLEARING AND STRIPPING

- A. Clear the site by removing and disposing of all obstructions such as fences, walls, foundations, buildings, accumulations of rubbish of whatever nature, shrubs, bushes, saplings, grass, weeds, stumps and other vegetation to a depth of at least 12" below proposed ground surface or proposed subgrade, whichever is lower. Removed materials shall be properly disposed offsite.
- B. After the area is cleared, strip topsoil to the depth of maximum 8" in areas of proposed structures or pavements.
- C. Sufficient topsoil shall be stockpiled in an area clear of the proposed construction for placement to a depth of 4" in proposed areas of turf, plantings and to fill planters. Excess topsoil shall be removed offsite.
- D. Subgrade preparation (at building and paving excavation and fill sections):
 1. Scarify and proof roll or otherwise mechanically test subgrade in new paving areas and in building slab areas.
 2. The Geotechnical Engineer will inspect the subgrade conditions and identify any unsuitable areas.
- E. Additional Excavation:
 1. Unsuitable areas will be undercut to a depth determined by the Geotechnical Engineer and replaced with suitable fill material compacted in accordance with fill compaction requirements specified herein.
 2. Unsuitable soils excavated as undercut will be removed from site.
 3. Rubble, debris, and rock excavated as undercut will be removed from the site and disposed of by the Contractor.
 4. Removal or reworking of unsuitable material and its replacement, as directed, will be paid for on basis of contract conditions relative to changes in the work.
- F. STOCKPILING
 1. Stockpile materials on site at locations designated by Owner.
 2. Stockpile in sufficient quantities to meet Project schedule and requirements.
 3. Separate differing materials with dividers or stockpile apart to prevent mixing.
 4. Prevent intermixing of soil types or contamination.
 5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
 6. Material shall be stockpiled on impervious material and covered over with same material, until disposal.

3.5 EXCAVATING

- A. Perform excavation within the project limits to the lines, grades, and elevations indicated and specified herein. Excavation is unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Excavated Materials:
 - 1. Satisfactory materials shall be used for fill or embankments within the project limits.
 - 2. Unsatisfactory materials shall be excavated to a depth below grade sufficient to provide a suitable subgrade support and backfill and compact with satisfactory materials.
- C. Surplus materials:
 - 1. Dispose of unsatisfactory excavated materials, and surplus excavated material, offsite at disposal areas arranged and paid for by the Contractor.
- D. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.
- E. Unauthorized Excavation:
 - 1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Geotechnical Engineer.
 - 2. Unauthorized excavation, as well as remedial work directed by Geotechnical Engineer shall be at Contractor's expense.
 - 3. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Geotechnical Engineer.
- F. Off-site Borrow:
 - 1. Obtain material required for fill or embankment in excess of that produced within the grading limits of the project from borrow areas selected and paid for by the Contractor and approved by the Owner or his/her representative. The Contractor shall obtain written agreements from the property owners for the removal of the materials.
- G. Stability of Excavations:
 - 1. Perform excavations and trenches in accordance with OSHA excavating and trenching rules and regulations.
 - 2. Slope sides or shore and brace where sloping is not possible because of space restrictions of stability of the materials being excavated.
 - 3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- H. Excavating for Structures:
 - 1. Excavate to elevations and dimensions shown within a tolerance of 0.05ft., and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services and for inspection.
 - 2. Excavation for footings and foundations shall not disturb the bottom of the excavation:
 - a. Excavate and trim with hand tools as necessary to final grade just before concrete is placed.

I. Excavating for pavements:

1. Excavate subgrade under pavements to within 0.05 ft of the proposed subgrade.
2. Prepare subgrade as specified herein.

J. Cold weather protection:

1. Protect excavation surfaces from freezing when an atmospheric temperature is less than 35 degrees F.

3.6 FILLING AND BACKFILLING

A. Backfill excavations as promptly as progress of the Work permits, but not until:

1. Acceptance of construction below finish grade.
2. Concrete formwork is removed.
3. Shoring and bracing are removed, and voids have been backfilled with satisfactory materials.
4. Trash and debris have been removed.

B. Ground surface preparation:

1. Remove vegetation, topsoil, obstructions, and deleterious materials from the ground surface prior to placement of embankment per Section 3.4.
2. Disk area to a depth of 8", unless sand or aggregate. Proof roll and prepare the surface per Section 3.8. Unsuitable material or material not achieving the specified density and moisture requirements after three consecutive good drying days of moisture conditioning and compaction, consisting of at least two processing's utilizing discs or tillers, shall be removed and/or replaced, or shall be further treated per instructions of the soils engineer. Additional work required after the three-day conditioning period to stabilize the material, when approved in writing by the Owner or his/her representative, shall be performed in accordance with Article 10 of the General Conditions.

C. Placing and compacting:

1. Place backfill and fill materials in layers not more than 8" in loose depth, unless otherwise approved by the A/E.
2. Before compacting, moisten or aerate each layer as necessary to provide the specified moisture content.
3. Compact each layer to required percentage of maximum density for the area.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
6. Prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.
7. The building embankment shall be constructed at minimum 5 feet beyond the proposed building line and pending approval of the compacted fill, shall be cut back at a 1:1 slope extending from the top of the proposed footing to 4 feet inside the building wall.
8. Placement of granular drainage material beneath the floor slab will be completed by the Building Contractor.

3.7 GRADING

A. General:

1. Uniformly grade the areas within project limits under this Section, including adjacent transition areas.
2. Finished surfaces within specified tolerance.
3. Compact with uniform levels or slopes between points where elevations are shown on the Drawings, or between such points and existing grades.
4. 4Where a change of slope is indicated on the Drawings, construct a rolled transition section having a minimum radius of approximately 8'-0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

B. Grading inside building lines:

1. Provide drainage away from structures during construction of the embankments to prevent ponding.
2. Finish surface within 0.05 foot of the proposed subbase elevation.

C. Grading outside building lines:

1. Provide drainage in areas adjacent to buildings away from the structures, and to prevent ponding.
2. Finish areas under walks and pavements to within 0.05 ft above or below the required subgrade elevation.

3.8 COMPACTING

A. Control material compaction during construction to provide the minimum Standard Proctor Density (SPD) specified, within moisture requirements, for each area as determined according to (ASTM D 698).

B. Place fill in 6"-8" uniform lifts.

C. Provide not less than the following minimum densities for layer or lift of material placed:

D. Compaction Recommendations		
Description	ASTM D 698	Moisture Content
Building Subgrades (Top 12")	95%+	-2% to +4%
Structural Fill/LVC	95%+	-2% to +4%
Footing Overexcavation Backfill	95%+	+/-2%

E.	Pavement Subbase (to a depth of at least 12")	98%	-2% to +2%
F.	Aggregate Base Course	98%	-2% to +2%

G. Moisture Control and Soils Content:

1. Moisture content for compaction purposes shall be within the ranges indicated as established by ASTM D698.
2. Existing ground surface or embankment layer of material if necessary shall be moisture-conditioned before compacting by:
 - a. For material below specified moisture parameters, uniformly apply water to surface of the material and incorporate with a disk or tiller in a manner to prevent free water from appearing on the surface during or subsequent compaction operations.
 - b. For material above the specified moisture parameters, air dry with disks and tillers.
 - c. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. at the Contractor's expense.
3. Process material to provide uniform moisture and clod reduction throughout.
4. Unsuitable material removed due to high moisture may be spread and allowed to dry until suitable.

H. Proof roll:

1. Prior to placement of granular subbase material on building and pavement areas, the subgrade shall be "proof rolled" with a pneumatic-tired, a three-wheel, or a tandem roller. The rollers shall weigh from 6 to 10 ton and develop not less than 200 pounds or more than 325 pounds per square inch of roller or tire surface. Any areas of significant deflection shall be removed and recompacted until stable.

3.9 EROSION PROTECTION

- A. The Contractor shall comply with soil erosion control requirements of the Missouri DNR and the local ordinances. The Contractor shall take all necessary measurements to protect against erosion and dust pollution on this project site and all off-site borrow or deposit areas, during performance or as a result of performance.
- B. The Contractor shall take all steps necessary to protect adjoining property, including public sanitary and storm drainage systems and streets, from any damage resulting from the movement of earth or other debris thereto from the site; and such steps as are necessary to prevent the accumulation of earth or debris on adjoining public or private property from the construction site. The Contractor shall take into consideration all factors which might cause the movement of earth or debris from the construction site onto any adjoining public or private property.
- C. The Contractor shall take immediate corrective action should damage occur to adjoining public or private property (including sanitary or storm drainage systems and streets). The Contractor shall take immediate corrective action to remove any debris should any earth or other debris move from the construction site to adjoining public or private property. Further, the Contractor

shall take steps required to prevent the repetition of any instance where dirt or other debris moves from the construction site to adjoining public or private property.

- D. The Contractor will hold the Owner harmless from any and all claims of any type whatsoever resulting from damages to adjoining public or private property, including reasonable attorney's fees incurred to Owner. Further, if the Contractor fails to take necessary steps to promptly remove earth or debris which comes onto adjoining public or private property, the Owner may, but need not, remove such debris and deduct the cost thereof from amounts due the Contractor.
- E. The Contractor shall maintain storm sewer systems throughout construction and provide erosion control measures acceptable to protect against siltation and erosion or any adverse conditions resulting from storm water. Use silt fence and other means at all intakes and outfall structures and at all locations where erosion or siltation is anticipated or occurring; including drainage courses and swales.

3.10 FIELD QUALITY CONTROL

- A. The Contractor shall provide testing services of a soils engineer and/or independent laboratory approved by the Owner.
- B. Upon completion of each test and/or inspection, promptly distribute copies of test or inspection reports to the A/E.
- C. Testing Requirements:
 - 1. Penetrometer Tests:
 - a. 1 per each spread footing.
 - b. 1 per 25' of lineal footing.
 - 2. Standard Proctor Density/Moisture (ASTM D 698):
 - a. 1 per the insitu fill material.
 - b. 1 per each source of offsite fill material.
 - 3. Field density/moisture tests (ASTM D6938):
 - a. Paved Areas: 1 per 2,500 sq ft per 8" lift.
 - b. Building Area: 1 per 2,500 sq ft per 8" lift.
 - 4. Liquid Limit and Plasticity Index
 - a. Building Area: 1 per each source of offsite fill material.

3.11 NATURAL AND ARTIFICIAL DRAINAGE

- A. If necessary, during the progress of the work, to interrupt the natural drainage of the surface water, Contractor shall provide approved temporary drainage facilities.
- B. If necessary to interrupt any field tile drains that might be encountered in this work, the Contractor shall restore or extend drains as necessary.

3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Project Site: Remove excess soils, including unacceptable excavated material, from site to an approved location on the coordinate with owner.
- B. Remove from the Owner's Property waste materials, trash, debris, utility pipes, etc. to an approved legal waste site.

3.13 MAINTENANCE

- A. Protection of newly graded areas:
 - 1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds;
 - 2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

3.14 CERTIFICATION

- A. A. Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Owner or his/her site representative a written report from the independent soils engineer or testing laboratory certifying that the compaction requirements have been obtained. Include in the report the soil classification, standard proctor density, optimum moisture content and plasticity index of the onsite and borrow materials used in the areas of embankment.

END OF SECTION 312300

SECTION 312313 - SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes soils investigation at the site, and use of data resulting from that investigation.

1.2 SOILS INVESTIGATION REPORT

- A. General:
 - 1. A soils investigation report has been prepared for the site by the soil investigation Engineer/Architect selected by the Owner.
- B. Use of Data:
 - 1. Information on the nature of the soil conditions previously encountered at the site which may be shown on the drawings or contained in the *Soils Report* has been provided for bidder's information and shall not be construed as a guarantee of the subsurface conditions.
 - 2. The Contractor should visit the site and shall be responsible for determining to his/her satisfaction, prior to bidding, the actual site conditions.
 - 3. A copy of the *Geotechnical Investigation, ISTS New Fitness Center* _____, performed by Geotechnics Soil & Material Testing, is attached at the end of the specifications, solely for the Contractor's information.

1.3 QUALITY ASSURANCE

- A. Readjust work performed that does not meet technical or design requirements, but make no deviation from the Contract Documents without specific and written approval from the Owner.

1.4 UNDERGROUND UTILITIES

- A. The drawings indicate the best knowledge of the Owner and Engineer/Architect on the general location and nature of the existing and/or proposed underground utilities in the area of construction. Exploratory excavations at the site to determine exact locations were not conducted.
- B. The Contractor shall be responsible for locating all utilities on site prior to the start of construction. At minimum the Contractor shall contact the Missouri One Call system at 1-800-DIG-RITE, 48 hours before scheduled work.
- C. Damages to utilities caused by the Contractor's failure to properly investigate existence in the area shall be the sole responsibility of the Contractor.

END OF SECTION 312313

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 312333 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Trench, backfill, compact, as specified herein, and as needed for installation of underground utilities associated with the work.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Bedding Materials:
 - 1. Aggregate materials consisting of sands stone screenings, crushed stone, pit run gravel, washed gravel.
- B. Fill and backfill materials:
 - 1. General: Soil materials removed from excavations or imported from off-site borrow areas free from organic matter and deleterious substances, and containing no rocks, stone or broken concrete over 4" in greatest dimension. No rocks larger than 1" diameter shall be permitted in the upper 12" of fill.
 - 2. Non-expansive Soils: Soil or granular materials free from organic matter and deleterious substances having a Standard Proctor Density greater than 100 pcf and a plastic limit less than 22.
 - 3. Structural Fill: Cohesionless granular materials free from organic material and other foreign matter, complying with the requirements of the Section the work is being performed.
 - 4. Granular Materials: Provide aggregate complying with requirements of Sections 310516 and 312300 of these Specifications.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

- A. Finish grading shall be bladed off to contours or elevations indicated on the drawings. Rocks and other debris unearthed during finish grading operations shall be removed from immediate construction area and disposed of elsewhere on site as approved by Owner and Engineer/Architect.
- B. Final disking, harrowing, raking etc. and other preparations for seeding, sod or landscaping will be by others.

3.3 PROCEDURES

- A. Utilities:
 - 1. The determination of the exact location of all existing facilities, and all other pipes, services and structures, and their proper protection, support and maintenance during all construction operations, is the expressed responsibility of the Contractor in the performance of his contract. Contractors are advised to secure any additional information, relative to the underground utility lines, by consulting with proper private and public officials, under whose jurisdiction the maintenance and operation of the utility lines lie, and/or by field investigations at his own expense.
 - 2. Wherever underground utilities are disturbed or damaged as a result of the construction work proposed herein and such utilities can be replaced at their original locations and grades with all costs in connection with such replacement work to be borne by the Contractor and no separate or extra payment will be made therefore.
- B. Protection of persons and property:
 - 1. Barricade open holes and depressions occurring as part of this Work.
 - 2. Consult with Owner during construction for any additional safety precautions.
- C. Dewatering:
 - 1. Remove all water, including rain water, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
 - 2. Keep excavations and site construction area free from water.

3.4 EXCAVATING

- A. Perform excavating within the limits of the Work to the lines, grades, and elevations indicated and specified herein.
- B. Surplus materials:
 - 1. Dispose of unsatisfactory excavated materials, and surplus excavated material.

- C. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.
- D. Excavation is unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.5 FILLING AND BACKFILLING

- A. Backfill excavations as promptly as progress of the Work permits, but not until:
 - 1. Acceptance of construction below finish grade.
 - 2. Concrete formwork is removed.
 - 3. Shoring and bracing are removed, and voids have been backfilled with satisfactory materials.
 - 4. Trash and debris have been removed.
- B. Ground surface preparation:
 - 1. Remove vegetation, topsoil, obstructions, and deleterious materials from the ground surface prior to placement of fills.
 - 2. When existing ground surface has a density less than that specified under "compacting" for the particular area, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.
- C. Placing and compacting:
 - 1. Place backfill and fill materials in layers not more than 8" in loose depth.
 - 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
 - 3. Compact each layer to required percentage of maximum density for the area.
 - 4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
 - 5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
 - 6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

3.6 COMPACTING

- A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to Standard Proctor Density (ASTM D 698).
- B. Provide not less than the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place. If using clean aggregate, relative density testing will be required.
 - 1. Backfill or fill under structures @ 95% of maximum density.
 - 2. Backfill or fill under pavements on earth @ 98% of maximum density.
 - 3. All other fill or backfill not within pavement or building areas @ 90% of maximum density.
 - 4. Compaction by jetting is not allowed.
- C. Moisture control:
 - 1. Where the backfill or layer of soil or aggregate material must be moisture-conditioned before compacting, uniformly apply water to the material or aerate to facilitate compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the soils engineer/architect.

3.7 FIELD QUALITY CONTROL

- A. The Contractor shall provide testing services of a soils engineer and/or independent laboratory approved by the Owner. Field density/moisture tests (ASTM D698):
 1. Trench Backfill: 1 per 100 feet per lift

3.8 MAINTENANCE

- A. Protection of newly graded areas:
 1. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

END OF SECTION 312333

SECTION 312513 - EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnishing, installing, maintaining, and removing all the measures necessary to prevent erosion in and around the construction area as shown on the Drawings and specified herein. The measures shall be maintained so the site will not experience further erosion of soil until the earthen areas are revegetated.
- B. Installation of temporary water pollution control measures to prevent discharge of pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage, or other harmful material from the project.

1.2 GENERAL

- A. The Contractor shall manage his operations to control water pollution in accordance with this specification and applicable State regulations. Construction of permanent drainage facilities and other contract work, contributing to control of erosion, shall be scheduled at the earliest practicable time.
- B. The Contractor shall furnish, install, maintain, and remove temporary erosion control measures. The Contractor shall prevent silt or polluted storm water discharge from the site.
- C. The Owner's Representative may require installation of additional erosion control facilities, by the Contractor, if in the sole opinion of the Owner's Representative, the Contractor's efforts are inadequate.

1.3 DEFINITIONS

- A. General Permit: The General Permit for storm water discharges associated with construction activity.
- B. Storm Water Pollution Prevention Plan (SWPPP): If required, a plan required by the General Permit that includes site map(s), an identification of construction/contractor activities that could cause pollutants in the storm water, and a description of measures or practices to control these pollutants.
- C. Best Management Practice (BMP): Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.
- D. Temporary Berm: A temporary ridge of compacted soil, with or without a shallow ditch, constructed at the top of slopes or transverse to the centerline of a slope. The berm diverts storm runoff to temporary outlets to discharge water with minimal erosion.
- E. Temporary Slope Drain: A temporary facility used to carry water down a slope.

- F. Ditch Check: An obstruction placed at frequent intervals across ditches, creating small ponds to cause sediment to settle and be contained.
- G. Sediment Basin: An excavated or dammed storage area to trap and store sediment and prevent the discharge of silt.
- H. Temporary Seeding and Mulching: Placement of a quick ground cover to reduce erosion in areas expected to be re-disturbed.
- I. Straw Bales: Standard agricultural bales used to filter the flow of water, trap, deposit sediment, and/or divert water.
- J. Wattle: A geotextile barrier fence to contain sediment by removing suspended particles from water passing through the fence.
- K. Temporary Pipe: Conduit utilized to carry water under haul roads, wattles, etc., and prevent equipment from direct contact with water when crossing an active or intermittent stream.

1.4 Sediment Removal: Removal of accumulated sediment to restore the efficiency of sediment control features.

- A. The Contractor shall review the Storm Water Pollution Prevention Plan (SWPPP) provided in these plans and make appropriate field corrections to the document, and submit final corrected copies of the SWPPP to the Owner and facility.

1.5 REFERENCES

- A. Sections 611, 806, and 807 of the *Missouri Standard Specifications for Highway Construction*, 2018, English Version, Missouri Highway and Transportation Commission herein noted as the Standard Specifications.
- B. Section 312300 – Excavation and Fill.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Straw or hay bales securely bound with wire or string.
- B. Excelsior Blanket: Complying with Section 806 of the MoDOT Standard Specifications.
- C. Wattles:
 - 1. Netting: Open weave, degradable netting. Nominal diameter of 9 inches, or as specified.
 - 2. Fill Material: Straw, wood excelsior, coir, or other natural materials approved by the Engineer.

3. Stakes: 1 inch by 1 inch (minimum) wooden stakes, or stakes of equivalent strength.
- D. Rock Lining: Section 609.60 Rock Ditch Liner, Type 2.
- E. Temporary slope drains: Stone, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe or flexible rubber pipe.
- F. Ditch Checks:
1. Rock ditch checks: 2" to 3" clean gravel or limestone.
 2. Straw bale ditch checks: Rectangular wheat straw bales in good condition.
 3. Wattle ditch checks: Geotextile meeting the requirements of this specification.
- G. Pipe: Corrugated metal (14 Ga.)
- H. Temporary Seeding:
1. December 1 to March 1: 50 lbs oats/acre.
 2. March 1 to December 1: 50 lbs cereal rye or wheat.
 3. Mulch shall be wheat straw.
- I. The Contractor shall furnish a manufacturer's certification, stating the material conforms to the requirements of these specifications.
- J. The certification shall include, or have attached, typical results of tests for the specified properties, representative of the materials supplied.
- K. The Owner's Representative reserves the right to sample and test any material offered for use.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Owner's Representative may limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, or fill operations.
- B. The Owner's Representative may direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams, other watercourses, lakes, ponds, or other areas of water impoundment. Work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, use of temporary mulches, seeding or other control devices or methods to control erosion.
- C. The Contractor shall incorporate permanent erosion control features at the earliest practicable time.
- D. The Contractor at no additional cost shall provide temporary pollution control measures needed to control erosion during normal construction practices to the Owner.

- E. Contractor shall designate trained and knowledgeable personnel to coordinate all SWPPP activities, and identify these personnel to the Owner's Representative during construction.
- F. The SWPPP is a living document. As the conditions of the site changes, the SWPPP should be updated by the Contractor.
- G. The SWPPP is subject to random inspection by the Owner. The SWPPP should be kept up to date by the Contractor and available for inspection at any time.
- H. If Contractor determines that any BMP should need modification, the changes shall be dated and documented, and all necessary field changes performed.

3.2 LIMITATION OF AREA DISTURBED:

- A. The Contractor's operations shall be scheduled to install permanent erosion control features immediately after clearing and grubbing, and grading.
- B. The surface area of erodible earth material exposed at one time by clearing and grubbing, excavating, fill, or borrow shall not exceed 200,000 square feet without written approval of the Owner's Representative.
- C. The Owner's Representative may limit the area of clearing and grubbing, excavation, borrow, and embankment operations commensurate with the Contractor's capability and progress in completing the finish grading, mulching, seeding, and other such permanent pollution control measures current.
- D. The Contractor shall respond to seasonal variations. If required by weather, temporary erosion control measures shall be taken immediately.

3.3 RIVERS, STREAMS, AND IMPOUNDMENTS:

- A. Construction operations in rivers, streams, and impoundments shall be restricted to areas, which must be entered for the construction of temporary or permanent structures.
- B. Rivers, streams, and impoundments shall be promptly cleared of falsework, piling, debris, or other obstructions as soon as practical.
- C. Frequent fording of live streams with construction equipment will not be permitted.
- D. Temporary bridges or other structures shall be used when the Contractor's operations include cycling of equipment across streams, rivers, or impoundments.
- E. Mechanized equipment shall not be operated in flowing streams except as required to construct channel changes and temporary or permanent structures.

3.4 BORROW AND WASTE AREAS

- A. Material pits other than commercially operated sources and material spoil areas shall be subject to pollution control measures of this specification. An offsite location does not relieve the Contractor of his contractual obligation to prevent the introduction of silt or other pollutants into receiving waterways.

3.5 CONFLICT WITH FEDERAL, STATE OR LOCAL LAWS, RULES OR REGULATIONS

- A. In case of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.6 TEMPORARY BERMS

- A. Temporary berms shall be constructed at the top of newly constructed slopes and / or transverse to grade to divert runoff and prevent erosion until permanent controls are installed and / or slopes are stabilized.
- B. Interceptor berms transverse to centerline may be used when temporary berms are installed on grades in excess of 1 percent and at locations where water is to be carried down the fill slope by temporary or permanent slope drains.

3.7 TEMPORARY SLOPE DRAINS

- A. General:
 - 1. Temporary slope drains are required to concentrate water flowing down a slope prior to installation of permanent facilities. Slope drains shall be placed at approximately 500-foot intervals or as directed by the Owner's Representative.
- B. General Requirements
 - 1. The Contractor shall install a temporary wattle in locations shown on the drawings, around inlets that accept flow carrying silt, and other locations necessary to prevent the discharge of silt from the site.
 - 2. Installation shall conform to the drawing detail.
 - 3. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading.
- C. Construction Requirements:
 - 1. Temporary slope drains shall be anchored to prevent disruption by the force of the water flowing in the drain.
 - 2. The inlet end shall be constructed to channel water into the drain.
 - 3. The outlet ends of these temporary slope drains shall have some means of dissipating the energy of this water to reduce erosion downstream.
 - 4. Unless otherwise directed by the Owner's Representative, temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

3.8 DITCH CHECKS

- A. General:
 - 1. Rock ditch checks may be used on ditches with grades of 4 percent or less.
 - 2. Straw bale ditch checks may be used on all ditches.

3. Wattle ditch check may be used on all ditches.
 4. A straw bale ditch check or a wattle ditch check may be used in lieu of a sediment basin for drainage areas less than two acres. The basin shall have a volume of 1,815 CF per acre of contributing drainage area.
- B. Construction Requirements:
1. Construct rock ditch checks in accordance with the drawing detail.
 - a. Achieve complete coverage of the ditch or swale and insure the center of the check is lower than the edges.
 2. Construct straw bale ditch checks in accordance with the drawing detail.
 3. Construct wattle ditch checks in accordance with the drawing detail.
- C. Maintenance:
1. Inspect ditch checks for sediment accumulation after each rainfall.
 2. Sediment shall be removed when it reaches one-half of the original height.
 - a. Regular inspections shall insure that the center of a rock check is lower than the edges. Correct erosion caused by high flows around the edges of the check immediately.

3.9 TEMPORARY SEEDING AND MULCHING

- A. General
1. This item is applicable to all projects.
 2. Seeding and/or mulching shall be a continuous operation on all cut slopes, fill slopes, and borrow pits during the construction process. All disturbed areas shall be seeded and mulched within five (5) working days after the last construction activity in all locations where necessary to eliminate erosion.
- B. Construction Requirements:
1. Permanent seeding and mulching following temporary seeding will be performed during the favorable seeding seasons only.
 2. Temporary seeding mixtures and planting season:
 - a. December 1 to March 1: 50 lbs. oat grain per acre
 - b. March 1 to December 1: 50 lbs. (cereal rye or wheat) per acre
 3. Temporary mulch, fertilizer, and lime for seeding:
 - a. Fertilizer and mulch for temporary seed mixtures shall be applied in accordance with Section 329219.
 - b. Fertilizer shall be applied at the rate specified for permanent seeding.
 - c. Lime will not be required for temporary seeding.

3.10 STRAW BALES

A. General

1. Install at the bottom of embankment slopes less than 10' high to divert runoff from sheet flow and intercept some of the sediment in the sheet flow.
2. Install as ditch checks in small ditches and drainage areas.
3. Install on the lower side of cleared areas to catch sediment from sheet flow.

B. Construction Requirements:

1. Bales of straw shall be utilized to control erosion, trap sediment, and divert runoff.
2. Bales must be adequately braced from behind.

3.11 TEMPORARY PIPE

A. General:

1. The Contractor shall install temporary pipes and fill at locations, to be crossed by the Contractor's equipment, which carry a concentrated flow during rain events.

B. Construction Requirements:

1. All temporary pipes shall be installed in the same manner as permanent pipe is installed on the project to assure that the water does not cause erosion around the pipe.
2. Material to backfill the pipe should be placed in 6" lifts and mechanically compacted. Compaction testing will not be required.

3.12 WATTLES

A. Installation:

1. Construct a shallow trench, 2 to 4 inches deep, matching the width and contour of the wattle.
2. Install wattle along contour of slope.
3. Turn ends of wattle uphill to prevent water from flowing around ends.
4. Place and compact excavated soil against the wattle, on the uphill side.
5. Drive stakes through the center of the wattle, into the ground at a maximum spacing of 4 feet along the length of the wattle, and as needed to secure the wattle and prevent movement.
6. Abut ends of adjacent wattles tightly. Wrap joint with a 36 inch wide section of silt fence and secure with stakes.

B. Maintenance:

1. When accumulated sediment reaches a level one-half the height of the wattle, or when the wattle becomes clogged with sediment and no longer allows runoff to

flow through, remove the wattle as described above, and replace according to the installation instructions above.

C. Removal:

1. When specified in the contract documents, or as directed by the Engineer, remove the wattle upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.
2. Completely remove the wattle netting, filler material, and stakes.
3. Spread the accumulated sediment to match finished grade and to ensure proper drainage.
4. When allowed by the Engineer, the wattle netting may be sliced open and the filler material spread out over the ground. Removal of netting and stakes and spreading of sediment is still required.

3.13 SEDIMENT REMOVAL

A. General

1. Sediment deposits shall be removed when:
 - a. The deposits reach approximately one-half the height of a ditch check, straw bale barrier or wattle.
 - b. The sediments have reduced the ponded volume of sediment basins to one-third of the original volume.
 - c. Requested by the Owner's Representative.

- B. Sediment removed from erosion control features shall be deposited in a location where it will not erode into construction areas or watercourses.

END OF SECTION 312513

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aggregate base course.
- B. Related Sections:
 - 1. Section 312300 – Excavation and Fill.
 - 2. Section 312333 – Trenching and Backfill.

1.2 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12-inch Drop.
- B. ASTM D3938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. MoDOT- Type 5.
- B. Geotextile fabric shall meet the requirements of Mirafi 160N or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate has been inspected, gradients and elevations are correct, and substrate is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to a total compacted thickness as shown on the drawings.

- B. Place aggregate in maximum 6-inch layers and roller compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- G. Compact to 98% of standard proctor maximum density.

3.4 TOLERANCES

- A. Flatness: Maximum variation of 1/2 inch measured with 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ASTM D698.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION 321123

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Parking Lot.
2. Sidewalks and Walkways.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
1. Portland Cement: ASTM C 150, Type I
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Coarse aggregate, uniformly graded. Provide aggregates from a single source.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- F. Classes of concrete:

Class	Uses	Strength (28 days)	Cement Content (min)
"Pavement Concrete" per Std. Specs	Exterior Structural elements, Slabs on Grade, General Concrete	4,000 psi	560 – lbs/Cu Yd

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Color: White

2.5 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: Maximum 4 inches.
 - 4. Air Content: 4.5 to 7.5.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M **and** ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a **3/8-inch** radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed pavement surfaces with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.9 PAVEMENT MARKING

- A. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.

- C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
- D. Pavement marking colors shall be as follows:
 - 1. Accessible Parking Stall Striping: Blue
 - 2. Standard Parking Stall Striping: White

3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 SEALANT

- A. The top ¼ inch of all expansion joints (excluding tooled joints) shall be sealed with a self-leveling polyurethane horizontal sealant complying with ASTM C920, Type M, Grade P, Class 25.
- B. Pavement joints shall be sealed with a self-leveling polyurethane horizontal sealant complying with ASTM C920, Type M, Grade P, Class 25..
 - 1. Joints shall be completely filled or over banded not to exceed 1½". Excessive over banding shall be removed.

3.12 FIELD QUALITY CONTROL

- A. The Contractor will provide testing services of a soils engineer and/or independent laboratory for this project.
- B. Upon completion of each test and/or inspection, promptly distribute copies of test or inspection reports to A/E.
- 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 the first 10 cu. yd. placed each day, plus one set for each additional 50 cu. yd. placed.
 - 2. Slump: Required 2"-4" - ASTM C 143/C 143M; one test at point of placement for each composite sample of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: Required 6% (-2%, +1%) - ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test per truck when air temperature is 35 deg F and below and when 85 deg F and above.
 - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample of each concrete mixture.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and laboratory cure one set of four (4) standard 6" x 12" or 4" x 8" cylinder specimens for each composite sample.
 - b. Cast and field cure one additional standard cylinder specimen for each composite sample for cold or hot weather concrete.
7. Compressive-Strength Tests: ASTM C 39/C 39M;
- a. If 6" x 12" cylinders are taken: test one of four laboratory-cured specimens at 7 days and one set of two specimens at 28 days. The fourth specimen will be a hold to serve as a spare if specimens do not reach their design strengths.
 - b. If 4" x 8" cylinders are taken: test one of five laboratory-cured specimens at 7 days and one set of three specimens at 28 days. The fifth specimen will be a hold to serve as a spare if specimens do not reach their design strengths.
 - c. A compressive-strength test shall be the average compressive strength from a set of two or three specimens obtained from same composite sample and tested at age indicated.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 329219 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. This part of the Specification includes all labor, materials, equipment and supervision required for Seeding.
2. This section includes the specifications for seedbed preparation; fertilization; seeding; and mulching.

1.2 SUBMITTALS

A. Manufacturers or vendor's certified analysis of fertilizer.

B. Seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each grass seed species.

C. Planting Schedule: Proposed seeding schedule, indicating dates for seeding work during normal seasons. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

D. Normal seasons for this work are as follows:

1. Spring: March 1 - May 31.
2. Fall: August 10 - September 30.

E. Furnish detailed written recommended maintenance program to the Owner with a copy to the Owner's Representative, prior to final inspection of the seeding.

1.3 QUALITY ASSURANCE

A. Subcontract seeding to a single firm specializing in seeding as specified.

B. Source Quality Control:

1. Ship seeding materials with certificates of inspection required by governing authorities.
2. Comply with regulations applicable to seeding materials.
3. Do not make substitutions. If specified material is not obtainable, submit proof of non-availability to Owner's Representative, together with proposal for use of equivalent material.
4. Analysis and Standards: Package standard products with manufacturers certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. If seed is mixed prior to delivery on site, it shall be tagged showing a guaranteed statement of composition of mixture and percentage of purity and germination of each variety.
- B. If seed is to be mixed at the site, it shall be delivered in original containers bearing producers certification of germination and purity.
- C. Tags shall show producers or dealers Missouri Permit Number and date of testing; test date shall be no more than 90 days previous to time of use.
- D. Fertilizers shall conform to State of Missouri laws and regulations. If delivered in bulk, bills of lading or other labels shall be furnished to the Landscape Architect or labels indicating analysis and weight information from each container shall be preserved and furnished to the Owner's Representative within twenty-four (24) hours of application.
- E. Handling of materials as recommended by manufacturer.
- F. Store all packaged materials off ground and protect from moisture and rodents.
- G. Storage of all materials in locations designated and approved by Owner's Representative.

1.5 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.
- B. Grade Stakes: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- C. Protect existing irrigation system, structures, utilities, sidewalks, pavements, and other facilities during seeding operations. Repair any damage at no cost to the Owner.

1.6 SEQUENCING & SCHEDULING

- A. Planting Time: Proceed with, and complete seeding as rapidly as portions of site become available, working within seasonal limitations for each kind of seed required.
- B. Chronological procedure for seeding is to remove any existing vegetation, disc, fertilize, prepare the seedbed, seed, and then mulch.
- C. Schedule seeding work to occur as roadway work progresses. Identify areas ready for seeding and obtain approval of Landscape Architect to proceed. As areas of seeding are completed, proceed in accordance with paragraph 3.06 INSPECTION AND ACCEPTANCE.

1.7 SPECIAL PROJECT WARRANTY

- A. Warranty lawns to provide specified germination and seed emergence.

PART 2 - PRODUCTS

2.1 FERTILIZER

- A. Grade: Commercial grade conforming to current requirements of the Missouri Department of Agriculture, uniform in composition, liquid or dry and free flowing.
- B. Formulation: 8:32:16, or plant food ratio of 1:4:2.

2.2 SEEDING MATERIALS

- A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America.
- B. Seed Mix: Commercial mix consisting of the following grass species:

Species	% of Mix by Weight	Germ
Turf-Type Tall Fescue	60%	90%
Tall Fescue	30%	90%
Perennial Ryegrass	10%	90%
TOTAL MIX	100%	90%

- C. Each seed mix bag shall bear supplier's "blue tag" certification.

2.3 STRAW MULCH

- A. If Hydro seeding is not performed, provide clean, weed free threshed straw of wheat, rye, or oats. Straw harvested after killing frost or during dormant periods as well as discolored, weathered, rotted, brittle, moldy, or caked materials is unacceptable.
- B. Fifty percent (50%) of fiber of each straw bale shall be ten inches (10") or longer.

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. Cultipacker: Use a pull-type cultipacker with individual rollers or wheels. The cultipacker must produce a corrugated surface on the area being compacted. Operate the cultipacker separately from all other operations, and do not attach the cultipacker to the seeder or disk, unless combined cultipacker seeder is manufactured for such use is utilized.
- B. Disk: When preparing a seedbed on ground having heavy vegetation, use a disk with cutaway blades. Use weights or other provisions to obtain proper cutting depth.

- C. Drop Seeder: Use one piece of equipment containing pulverizer rollers in front of the seed tubes, ground driven seed meters, maximum seed tube spacing of 3 inches delivering seed between the pulverizer rollers and packer wheels, and packer wheels that press and firmly pack seed into the soil.
- D. Endgate Cyclone Seeders: Endgate cyclone seeders must be suitably mounted. Movement must be provided by mechanical means. The seed drops through an adjustable flow regulator onto a rotating, power driven, horizontal disk or fan.
- E. Field Tiller: Tiller designed for the preparation of the seedbed as specified.
- F. Gravity Seeders: Gravity seeders must provide agitation of the seed, have an adjustable gate opening, and uniformly distribute seed on the prepared seedbed. Use a seed hopper equipped with baffle plates spaced no more than 2 feet apart. The baffle plates must extend from the agitator shaft to within approximately 2 inches of the top of the seed hopper. Wind guards are required to facilitate seeding when moderate wind conditions exist. Place wind guards in front or in back (or both) of the seed outlet and extend them to near the ground line.
- G. Hydraulic Seeder: Use hydraulic seeding equipment with a pump rated at no less than 100 gallons per minute. Inoculant, seed, and fertilizer may be applied in a single operation. The equipment must have a suitable working pressure and a nozzle adapted to the type of work. Supply tanks must have a means of agitation. Calibrate tanks and provide them with a calibration stick or other approved device to indicate the volume used or remaining in the tank.
- H. Mowers: Shall be rotary, flail, disk, or sickle type. Do not use mowers that bunch or windrow the mowed material.
- I. Mulch Anchoring Equipment: Equipment designed to anchor straw or hay mulch into soil by means of dull blades or disks. It shall have flat blades or disks, may have cutaway edges and must be spaced at approximately 8 inch intervals. The mulch anchoring equipment must be pulled by mechanical means and have sufficient weight to crimp the straw.
- J. Native Grass Seed Drill: Use a native grass seed drill designed to provide uniform distribution of native grass and wildflower seeds. Provide separate seed boxes to apply both small seeds as well as fluffy bearded seeds. If a no-till attachment is specified, use an attachment of the same manufacturer as the drill.
- K. Rotary Tiller: Equipment with rotary-type blades designed for the preparation of seedbed as specified.
- L. Slit Seeder: Use a gas, diesel or electric powered mechanical slit seeder that is capable of cutting vertical grooves a maximum of 1/4 inch deep into the soil with a maximum horizontal blade spacing of 3 inches, deposits metered seed directly after the formation of the vertical grooves, and contains packer wheels that press and firmly pack seed into the soil.
- M. Straw Mulching Machine: Use a machine to uniformly apply mulch material over the desired area without excessive pulverization. Excessive pulverization is the general absence of straw longer than 6 inches after distribution.

3.2 SEEDBED PREPARATION

- A. Limit preparation of seedbed to areas that will be seeded immediately upon completion.

- B. Work areas accessible to field equipment to a depth of no less than 3 inches. Use mechanical rotary tillage equipment for the preparation of seedbed on earth shoulders, urban or raised medians, and rest areas. Prepare by hand areas inaccessible to field machinery, to a depth of no less than 2 inches. Where weed growth has developed extensively, they may be disked into the ground. If weed growth develops sufficiently to interfere with proper seedbed preparation, mow the weeds and remove them from the project at no additional cost to the Owner.
- C. Use crawler type or dual-wheeled tractors for seedbed preparation. Operate equipment in a manner to minimize displacement of soil and disturbance of the design grading. Harrow ridging in excess of 4 inches due to operation of tillage equipment prior to rolling with the cultipacker. Roll the area with no less than one pass of the cultipacker prior to seeding.
- D. Shape and fine grade to remove rills or gullies, water pockets, undesirable vegetation, and irregularities to provide a smooth, firm, and even surface true to grade and cross- section. Prepare to a fine texture and without soil lumps. Till parallel to the contours.
- E. Smooth the seedbed with a cultivator-type tillage tool having a rake bar or a rock rake. Pick up and remove all debris, such as rocks, stones, concrete larger than 2 inches (1/2 inch maximum for lawn seeding), or roots and other objectionable material that will interfere with the seeding operation. A spring tooth cultivator may be used in lieu of a rock picker. Remove the rock by hand after each use of the cultivator; repeat the process until the soil is relatively free of rock.
- F. Choose equipment to minimize soil compaction. Operate equipment in a manner to minimize displacement of soil and disturbance of the design grading. Roll the area with at least one pass of the cultipacker. Remove ruts that develop during the sequence of operations before subsequent operations are performed. This must be completed just prior to seeding.

3.3 FERTILIZATION

- 3.4 A. Apply fertilizer immediately prior to seedbed preparation. Incorporate the fertilizer into the top 2 to 3 inches of topsoil during the seedbed preparation. Equipment that results in ruts or excessive compaction will not be allowed.
- B. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

3.5 CONVENTIONAL SEEDING

- A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- B. Use methods and procedures consistent with equipment manufacturer's recommendations; however, do not operate ground-driven equipment at speeds greater than 10 mph.
- C. On all areas accessible to machinery, sow seed with a gravity seeder, endgate cyclone seeder, or seed drill. Each application of seed shall overlap the previous application by one-half (1/2) the application width to insure double coverage.
- D. On areas inaccessible to field machinery, the use of hand-operated cyclone seeders will be allowed, but no other hand-seeding methods will be accepted.
- E. All seeded areas will have one pass with a roller or cultipacker to firm the soil.

- F. Sow seed mix at the rate of 8-10 lbs. per 1000 sq. ft.

3.6 HYDRAULIC SEEDING

A. Order of Operations:

1. Seedbed Preparation
2. Seed application, fertilizing and mulching

B. Seedbed Preparation: Follow seedbed preparation for conventional seeding.

C. Seed Application, Fertilizing and Mulching:

1. Application Process:

- a. Combination: Place all material, seed, fertilizer, mulch, and tackifier (if applicable) in hydraulic mulching equipment specifically manufactured for hydraulic seeding.
 - b. Separate: At the Contractor's option and at no additional cost to the Owner, the hydraulic seeding, fertilizing, and mulching may be undertaken separately. If operations are undertaken separately, complete fertilizing and mulching application within 24 hours of completing seeding work. Do not separate the applications if inclement weather is forecasted within 24 hours of the scheduled application period.
2. Ensure the hydraulic equipment, pump, and application process do not damage or crack seeds.
 3. Mix materials with fresh potable water using a combination of both recirculation through the equipment's pump, and mechanical agitation to form a homogeneous slurry.
 4. Apply mixture within 1 hour after seed and fertilizer are placed in the hydraulic seeder.
 5. If necessary, dampen dry, dusty soil, to prevent balling of the material during application.
 6. Apply the slurry evenly over all specified areas at component material rates specified.
 - a. Wood Cellulose Mulch:
 - 1) Mulch: Minimum 3,000 lb./acre dry weight.
 - 2) Tackifier: Minimum 50 lb./acre.
 - b. Bonded Fiber Matrix: Minimum 3,000 lb./acre dry weight.
 - c. Mechanically bonded Fiber Matrix: Minimum 3,000 lb./acre dry weight.
 7. Provide documentation to ensure final application rate.

3.7 MULCHING

- A. Protect seeded areas against erosion by spreading specified mulch after completion of seeding operations.
- B. Spread uniformly to form a continuous blanket and apply at a rate of one and one half (1 1/2) tons per acre.
- C. Anchor mulch by crimping into the soil a minimum depth of two inches (2").
- D. Provide and install additional erosion control materials where shown on the drawings.

3.8 WATERING

- A. Provide water, equipment, transportation, water tanker, hoses, and sprinklers.
- B. Use enough water to keep the soil and mulch moist to a depth of 1 inch and ensure growth of the seed. For turfgrass seeding areas, sufficiently water to keep the soil moist for a minimum of 21 days. If natural rainfall is adequate to keep the soil and mulch moist, artificial watering may not be needed.

3.9 RE-SEEDING

- A. When all work related to seeding, fertilizing, and/or mulching has been completed on an area, and is washed out or damaged, re-seed, fertilize, and/or mulch the area as necessary at no additional cost to the Owner.
- B. The contractor shall be responsible for maintaining erosion control throughout construction.

3.10 CLEANUP AND PROTECTION

- A. All work related to clean up throughout the project and upon completion is the responsibility of the Contractor, at no additional cost to the Owner.
- B. Restore to proposed grade, reseed, and remulch all eroded and/or washed out areas which develop prior to acceptance of seed.
- C. During seeding work, keep pavements clean and work area in an orderly condition. Remove all excess materials, debris, and equipment upon completion of work.
- D. Repair any damage resulting from seeding operations.
- E. Upon completion of job, clean-up all debris, caused by work, and excess material and leave area within contract limits in a neat and clean condition. Remove hydraulic slurry and other excess debris related to seeding operations from buildings, landscaping, mulch, pavement, signs, sign posts, and any other areas not specified for application, at the end of each day.

3.11 ACCEPTANCE AND WARRANTY

- A. Guarantee in writing that all work has been completed as specified and provide the date that all activities were completed. Upon completion of the work and fulfillment of the requirements of this Section, notify the Owner's Representative in writing that the work is ready for final inspection.
- B. Request a definite date for final inspection.
- C. Notify the Owner's Representative five (5) days prior to the requested final inspection date.
- D. Acceptance will occur, provided seeded areas are in a live, healthy, growing, and well- established condition without eroded areas, bare spots, weeds, undesirable grasses, disease, or insects. Any areas having less than 90% coverage will not be accepted.
- E. Projects will be accepted no sooner than 60 days from the date that all activities were completed.

- F. Reseed and maintain all seeded lawn areas which do not meet the requirements of this Section at the time of final inspection. Reseeded areas will be accepted no sooner than 60 days from the date that reseeding occurred.
- G. Replacement work shall be as specified for original seeding.
- H. Replacement work shall be reinspected before acceptance.

END OF SECTION 329219

SECTION 329300 - LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Trees.
 - 2. Shrubs.
 - 3. Ground cover.
 - 4. Plants.
 - 5. Mulch.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples of mulch.
- C. Product certificates.
- D. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.
 - 1. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.
- B. Handle planting stock by root ball.
- C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.6 WARRANTY

- A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees and Shrubs: One year.
 - b. Ground Cover and Plants: Six months.

1.7 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.
 - 1. Maintenance Period for Trees and Shrubs: Three months from date of Substantial Completion.
 - 2. Maintenance Period for Ground Covers and Plants: Three months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1.
- C. Provide balled and burlapped trees.
- D. Shrub sizes indicated on Drawings are sizes after pruning.

2.2 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.3 PLANTS

- A. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.
- B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.
- C. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

2.4 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth. The topsoil shall be free of aggregate.
 - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

2.5 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.6 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.7 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.8 MULCHES

- A. Organic Mulch: Shredded Cypress Mulch
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m.
- C. Mineral Mulch: River Run Gravel
 - 1. Size Range: 3 inch maximum, 2 inch minimum
 - 2. Color: Uniform brown color range acceptable to Engineer.

2.9 WEED-CONTROL BARRIERS

- A. Polyethylene Sheeting: ASTM D 4397, black, 0.006-inch minimum thickness.
- B. Nonwoven Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum. DeWitt or approved equal spunbonded polypropylene weed barrier having a tensile strength of 135 lbs. and a permeability of 70 gallons per square yard.

2.10 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
 - 1. Ratio of Loose Peat to Topsoil by Volume: 1:4.

2.11 EDGING

- A. Landscape edging shall be 12 gauge, 3/16 inch steel commercial grade, 6 inch height with 16 inch stakes. The edging shall be standard powder coated green.

PART 3 - EXECUTION

3.1 PLANTING BED ESTABLISHMENT

- A. Loosen subgrade of planting beds to a minimum depth of 6 inches. Remove stones larger than 1/2 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading; or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.2 TREES AND SHRUBS

- A. Excavation of Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base, leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
1. Excavate approximately three times as wide as ball diameter.
 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
- B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- C. Stock with Root Balls: Set trees and shrubs plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
1. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 2. Balled and Potted and Container Grown: Carefully remove root ball from container without damaging root ball or plant.
 3. Fabric Bag Grown: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 4. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- D. Bare-Root Stock: Set and support bare-root trees and shrubs in center of pit or trench with trunk flare 1 inch above adjacent finish grade. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots. Tamp final layer of backfill. Remove injured roots by cutting cleanly; do not break.
- E. Organic Mulching: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.

3.3 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.

- B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.

3.4 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants at spacing indicated on the drawings.
- B. Dig holes large enough to allow spreading of roots and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.5 PLANTING BED MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches. Tape or pin seams as recommended by manufacturer.
- B. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas.
 - 1. Organic Mulch and Mineral Mulch: Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.6 PLANT MAINTENANCE

- A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.
- C. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 329300

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 331110 - SITE WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pipe and fittings for site water line including domestic water line, fire water line and valves, fire hydrants.
- B. Related Sections:
 - 1. Section 312316 - Excavation and Fill.
 - 2. Section 312333 – Trenching and Backfilling.

1.2 SUBMITTALS

- A. Section 013300 - Submittals
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.
- B. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- C. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- D. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- E. AWWA C502 (American Water Works Association) - Dry Barrel Fire Hydrants.
- F. AWWA C509 (American Water Works Association) - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
- G. AWWA C900 (American Water Works Association) - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017700 - Contract Closeout: Closeout procedures.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 WATER PIPE

- A. PVC Pipe: AWWA C900 Class 150 DR-18:
 - 1. Fittings: AWWA C111, cast iron. Cor-blue steel bolts.
 - 2. Joints: ASTM D3139 compression gasket ring.
 - 3. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C 151, with push-on-joint, bell-and plain-spigot end, unless flanged ends are indicated. Class 150.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C 110, ductile- or gray-iron, standard pattern; or AWWA C 153, ductile-iron, compact pattern.
 - a. Gaskets: AWWA C 111, rubber.
- C. Service Pipe: 2 inches or smaller:
 - 1. Type K Copper.

2.2 GATE VALVES - 3 INCHES AND OVER

- A. Manufacturers:
 - 1. Mueller.
 - 2. American Flow Control.
 - 3. U.S. Pipe
- B. AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, control rod, extension box, epoxy coated interior.
- C. R.W. Type. Open Left.

2.3 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type A1 as specified in Section 310516.
- B. Cover: Fill Type A1, as specified in Section 310516.

2.4 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 321313.
- B. Service Boxes: Tyler 95E, with lid marked water.
- C. Mainline valve boxes: two piece, screw type Tyler Series 6850, with 5-1/4" drop lid marked water.
- D. Mainline Couplings: Smith-Blain 442 cast coupling or equal.
- E. Corporation and curb stops: Ball valve type. Corporations have CC tapered threads. Ford or Mueller. Corporation stops - Ford F600 or equal. Curb stops - Ford B21 or B22 or equal.
- F. Swivel quarter or eight bends: Ford L02 or LA02 or equal.
- G. Trace wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 312333 for Work of this Section.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 9 sq ft thrust restraint bearing on subsoil.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent.

- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent.
- E. Maintain optimum moisture content of fill material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with Missouri DNR requirements.
- B. Group piping with other site piping work whenever practical.
- C. Route pipe in straight line.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Slope water pipe and position drains at low points.
- F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- G. Establish elevations of buried piping to ensure not less than 5 ft of cover.
- H. Install trace wire continuous over top of pipe. Buried 6 inches below finish grade, above pipe line; coordinate with Section 312333. Bring tracer wire into valve boxes and coil at the top or bring to a junction box attached to a fire hydrant at the surface.
- I. Backfill trench in accordance with Section 312333.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- D. Set hydrants to grade, with nozzles at least 20 inches above ground.
- E. Locate control valve 4 inches away from hydrant.
- F. Provide a drainage pit 36 inches square by 24 inches deep filled with 1/2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- G. Compaction testing will be performed in accordance with ASTM D698, ASTM D2922, ASTM D3017.
- H. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 331110

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide storm sewerage system were shown on the Drawings, and as specified herein.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

- A. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.3 REFERENCES

- A. Standard Specifications for Missouri Department of Transportation, 2018, herein noted as the Standard Specifications.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS FOR SEWERS

- A. Sewer pipe shall comply with Sections 1026 & 1027 & 1028 of the Standard Specifications for the type, class, and size of pipe as shown on the Plans and as described herein:
- B. In addition to the list of materials in Sections 1026 & 1027 the following materials shall be used when specified:
 - 1. Corrugated HDPE Smooth Interior Pipe:
 - a. HDPE Smooth Interior, AASHTO M 294. Pipe does not have to meet the AASHTO M 294 Section 6 – Materials: Requiring pipe and fittings be made of virgin PE compounds. A percentage of recycled material may be utilized. All remaining requirements as set forth in AASHTO M 294 shall be met or exceeded.
 - 2. Polyvinyl Chloride (PVC) Pipe:
 - a. Conforming to ASTM D 1784 "Rigid Poly (Vinyl Chloride) and Chlorinated Poly (Vinyl Chloride) Compounds" and the latest revisions of ASTM D 2241 or 3034 (SDR 26) as specified. Include the appropriate ASTM Designations and Cell Classification Numbers (12454-B or 12454-C) or other approved classifications).
 - 3. Corrugated Metal Culvert Pipe:

- a. 12 Gauge
- 4. Joints:
 - a. PVC Pipe joints shall be flexible elastomeric seals as noted:
 - 1) ASTM D 3212.
 - 2) ASTM D 2855.
 - 3) ASTM F 477.
- C. Pipe Drains, Underdrains and French Drains materials shall comply with Section 605 of the Standard Specifications for the type, class, and size of pipe as shown on the Plans and as described herein.
- D. Manholes, Inlets, and Drainage Structure materials shall comply with applicable Section 604, 726, 731, 732 & 733 of the Standard Specifications for the type of structure, frame and grate or lid as shown on the Plans and as described herein.

PART 3 - EXECUTION

3.1 PREPARATION & LAYOUT

- A. Before starting excavation, establish location and extent of underground utilities occurring in the work area. Utilities shown on the plans indicate the best knowledge of the Owner with regard to general location and nature of the facilities in the area. They are shown for the convenience of the Contractor and shall not relieve the Contractor of the responsibility to properly investigate and protect the utilities. The Contractor shall remain responsible for damages to existing utilities whether indicated on the plans or not.
- B. The Contractor shall notify the Missouri One Call System (1-800-DIG-RITE) and the Owner or his/her site representative 48 hours prior to start of work.
- C. Field Conditions: Verify location and elevation of existing facilities where connections are to be made.

3.2 INSTALLATION

- A. Storm sewer pipe and structures shall be installed in accordance with applicable Sections 604, 605, 726, 731, 732 & 733 of the Standard Specifications.
- B. Excavation and backfilling for sewers, manholes, structures and appurtenances, shall comply with governing Federal State laws and municipal Ordinances as may be necessary to protect life, property, or the work. In any event, the minimum protection shall conform to the rules and regulations of the Occupational Safety and Health Act (OSHA) Standards for Construction.
- C. Line and Grade
 - 1. Reference points and bench marks for controlling lines and grades are shown on the Drawings. All additional horizontal and vertical measurements that will be required to complete the work, in addition to the controlling lines and grades, shall be the responsibility of the Contractor.
- D. Backfilling Trenches

1. Backfill above the center line of the pipe shall be in accordance with Section 726 of the Standard Specifications, as shown on the Drawings.
2. Aggregate trench backfill shall be placed beneath and within 2 ft. of areas of proposed pavements, walks, footings, foundations, slabs or other structures.
3. Jetting or watersoaking to obtain compaction will not be allowed.
4. Compaction of the backfill shall be based on Standard Proctor Density (ASTM D698) methods and shall meet the following requirements:
 - a.

Area/Condition	Percent of Std Proctor
1) Footings, Foundation	95%
2) Pavements, walks, floor slabs	98%

END OF SECTION 334100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 334101 - SANITARY SEWERAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide sanitary sewerage system including construction and installation of piping, manholes, and structures as specified herein, and conforming in all respects to the lines and grades shown on the Drawings, together with all specified or necessary accessories and appurtenances.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

- A. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 016600.

1.5 PERMITS AND ENTRY UPON LANDS

- A. The Owner will obtain permits and/or easements for entering upon private lands, public streets, roads and highways, railroads, etc. to the limits and lines shown on the Plans for construction purposes. The Contractor shall confine his operations to the outlined areas and shall comply with all special instructions shown on the Plans or set forth in the Contract Documents.

1.6 UTILITIES

- A. Existing underground utilities are herein defined as consumer service connections, such as water, gas, sewer, electric, telephone, etc., and also culverts, sanitary sewers, storm sewers,

combined sewers, water mains, underground power lines, gas mains and the usual appurtenances thereto.

1. No attempt is made to indicate or show accurate location of all underground utilities in the line of, or crossing the proposed work. In general, wherever record information was available of locations and wherever field location was possible during surveys, the approximate position of utilities is shown on the Plans. These are primarily for the purpose of indicating the approximate position of the underground lines with respect to the proposed sewer lines.
2. The determination of the exact location of all existing facilities, and all other pipes, services and structures, and their proper protection, support and maintenance during all construction operations; it is the expressed responsibility of the Contractor in the performance of this contract. Contractors are advised to secure any additional information, relative to the underground utility lines, by consulting with proper private and public officials, under whose jurisdiction the maintenance and operation of the utility lines lie, and/or by field investigations at his own expense.
3. Wherever underground utilities are disturbed or damaged as a result of the construction work proposed herein and such utilities can be replaced at their original locations and grades, all costs in connection with such replacement work shall be borne by the Contractor and no separate or extra payment will be made therefore.
4. Where existing underground utilities are in actual contact with the new work, so that such utilities cannot be replaced as originally found prior to excavation, and where relocation and changes are required, then the work shall be replaced or relocated by "others" at no cost to the Contractor. The Contractor shall so coordinate his work as to allow a reasonable time for such replacement or relocation and in no event shall extra compensation be allowed for such coordination or any reasonable delay occasioned there from. Should it be found necessary or desirable by the Owner for the Contractor to perform the work of replacement or relocation, the Engineer/Architect will issue in writing a field order defining the extent of the additional work and instructing the Contractor to proceed with such construction. Compensation for such work shall be determined as set forth in the General Specifications, under "Extra, Additional, or Omitted Work - Payment."

1.7 TREES, SHRUBBERY, STRUCTURES AND ABOVE GROUND UTILITIES

- A. All trees, shrubbery, utility poles and the like in the line of work shall be protected and preserved except as shown on the Plans, unless permission of the Owner and approval of the Engineer/Architect are obtained for their removal. Construction operations may require hand trenching and tunneling under and adjacent to trees and poles, which are to be preserved.
 1. Private and/or public walls, steps, walks, drives, roads, roadbeds, fences or other structures except trees in the line of work shall be replaced to as good a condition as prior to the start of excavation.
 2. All grassed surface areas shall be replaced to a condition equal to that found prior to the start of work.
 3. Erosion control measures shall be in accordance with Standard Specifications for Soil Erosion and Sediment Control as contained in IEPA/WPC/87-012 or current edition.
 4. Existing structures and markers such as inlet castings, fire hydrants, highway and street signs, valve boxes, etc., that may be disturbed during the progress of the work, shall be cleaned and reset in their original position in such a manner as may be required by the Engineer/Architect.

PART 2 - PRODUCTS

2.1 SEWER PIPE

- A. Vitrified Clay Pipe (ESVCP) conforming to ASTM C 700 (Extra Strength).
- B. Concrete Pipe, Reinforced (RCCP) conforming to ASTM C 76, Classes I, II, III, IV, or V.
- C. Ductile Iron Pipe (DIP) conforming to ANSI A-21.51 (AWWA C-151) Thickness designed per ANSI A 21.50 (AWWA C-150) tar (seal) coated and/or cement lined per ANSI A-21.4 (AWWA C-104).
- D. Polyvinyl Chloride (PVC) Pipe conforming to ASTM D 1784 "Rigid Poly (Vinyl Chloride) and Chlorinated Poly (Vinyl Chloride) Compounds" and ASTM D 2241 latest revisions. Minimum acceptable SDR shall be 26. Include the appropriate ASTM Designations and Cell Classification Numbers (12454-B or 12454-C) or other approved classifications).

2.2 JOINTS

- A. Extra Strength Vitrified Clay Pipe joints shall conform to ASTM C 425. Plain end VCP shall be with PVC bell material conforming to ASTM C 1784 and flexible gasket meeting ASTM C-425 specifications.
- B. Concrete Pipe joints shall be confined O-ring Type conform to the latest ASTM C 361.
- C. Ductile Iron Pipe shall have push-on or mechanical joints complying with the latest revision of ANSI/AWWA Specification C111/ A-21.11.
- D. PVC Pipe joints shall use flexible elastomeric seals per ASTM D 3212.

2.3 CONCRETE

- A. All concrete for manhole bottoms, special structures, and incidental items shall be as specified in Section 033000.

2.4 CASING PIPE

- A. Steel casing pipe of the diameter and thickness specified in the plans for Cathodically Protected Pipe or Non-Cathodically Protected pipe. Minimum yield strength of 35,000 psi.

2.5 SEAL PLUGS

- A. Seal plugs for all service lateral openings shall be air tight, as manufactured by Fernco Joint Sealer Co., Ferndale, Mich., or approved equal.

2.6 MANHOLE

- A. Manholes shall be precast reinforced concrete manhole sections and bases with rubber gasket joints complying with latest revisions of ASTM C 478. Diameter shall be 48" for sewer pipes 15" and smaller, and 60" for sewer pipes up to 36".
- B. Manhole steps shall be copolymer polypropylene plastic with steel reinforcement, (PS2-PF), or equal, and meet or exceed ASTM specifications D 2146 under Type 2 Grade 49108.
- C. Opening for sewer pipe connections shall be resilient connectors meeting the latest revisions of ASTM C923.
- D. Manholes shall be provided with cast iron frame and closed lids, (Neenah R-1015) or equal when located within the roadbed or buried conditions. Use a Neenah R-1077-B Frame and Type B lid or equal at other locations. All manhole lids shall be furnished with small pick holes.

2.7 BEDDING OR GRANULAR CRADLE

- A. Bedding or Granular cradle material shall comply with ASTM D2321, Class II, consisting of coarse sands and gravels with a maximum particle size of 20 mm (3/4in.), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive.

2.8 SELECT GRANULAR BACKFILL

- A. Select Granular Backfill materials shall consist of sand, crushed stone, pit run or crushed gravel well graded within the following limits.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
- B. Field Measurements - Make necessary measurements in the field to assure precise fit of items in accordance with the approved design.

3.2 INSTALLATION - TRENCH EXCAVATION

- A. All excavation work for sewers, manholes, sewer structure and sewer appurtenances, as herein defined, includes the clearing of the site of the work, the loosening, loading, removal, transporting and disposing of all excavated materials, wet or dry, necessary to be removed and replaced (backfilling) for purposes of sewer construction. All excavation shall be unclassified unless otherwise specifically specified. The ground shall, in general, be excavated in open trenches unless otherwise shown on the Drawings to be bored and jacked and/or in tunnel.

- B. Trenches shall be excavated to the depth required for the bedding and foundations of the sewers and appurtenances shown on the Drawings and profiles; and, where conditions make it necessary, to such additional depths as may be directed in writing by the Engineer/Architect.
- C. Should the trench be excavated without written authority to a depth greater than that required by the said Drawings and profiles, the Contractor shall refill such excess excavation at his own expense, with crushed stone which shall be tamped until solid, with 2000 psi concrete, or as otherwise directed by the Engineer/Architect.
- D. Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unsuitable soil, unless other special construction methods are called for on the Drawings, all such unsuitable soil under the pipe and for the width of the trench shall be removed and replaced with well compacted bedding material, as may be directed in writing by the Engineer/Architect.
- E. Whenever excavation is made for installing sewer pipe across private property, the top soil disturbed by excavation operations shall be replaced as nearly as possible in its original position, and the whole area involved in the construction operations shall be left in a neat and presentable condition.
- F. The width of the trench at the top of the sewer pipes shall be as shown on the Drawings at Trench Detail. However, a greater width may be permitted by the Engineer/Architect, in writing, when it is necessary for the proper construction of the sewer according to the plan.
- G. In general, trenches shall be only of sufficient width to provide a free working space on each side of the sewer pipe according to the size of the pipe and the character of the ground as shown on the Drawings; but in every case there shall be sufficient space between the pipe and the side of the trench, not less than six (6) inches, to make it possible to thoroughly ram the bedding around the pipe and to secure proper tight joints.
- H. All surplus excavated material, debris and rubbish shall be removed from the site by the Contractor.
- I. When the Contractor constructs the trench with sloped sides or benched, backfilling for the full width of the excavation shall be as hereinbefore specified, except no additional compensation will be allowed for trench backfill material required outside the limits of the specified trench width.
- J. In general, the Contractor shall furnish suitable spoil areas, but the Engineer/Architect reserves the right to designate certain spoil areas, provided the haul distance shall not exceed one (1) mile.
- K. The Contractor must take full responsibility and the risk of meeting quicksand, hardpan, boulder clay, rubbish, unforeseen obstacles, underground conduits, railroad tracks, pavements, etc. No claim for any amount of money, beyond the contract price of the work, will be entertained or allowed on account of the character of the ground in which the trench or other excavations are made, except for removal of unsuitable sewer pipe foundation material as authorized by the Engineer/Architect.

3.3 LINE AND GRADE

- A. Reference points and bench marks for controlling lines and grades will be established by the Engineer/Architect. Such work shall consist of referenced locations of all points of intersection, 800 feet apart. All additional horizontal and vertical measurements that will be required to complete the work, in addition to the controlling lines and grades, shall be made by the Contractor and at his sole responsibility. No compensation shall be paid the Contractor for the cost of any of the work or for delay occasioned by giving lines and grades or for inspection; but such cost shall be included in the prices specified for the appropriate items.

3.4 ROCK EXCAVATION AND BLASTING

- A. Wherever rock is encountered in the trench excavation, it shall be removed to a depth of six (6") inches below the sewer pipe as shown in detail on the Drawings.
- B. Extreme care shall be used wherever blasting is necessary for the removal of rock, large boulders, or other hard material. The Contractor shall conform his acts to and shall obey all rules and regulations for the protection of life and property that may be imposed by any public authorities or that may be made from time to time by the Engineer/Architect relative to the storing and handling of explosives and the loading and firing of blasts. Signals of danger shall be given before the firing of any blast and blasts shall not be fired until all persons in the vicinity are known to have reached positions out of danger there from.
- C. In case injury occurs to any portion of the work, or to the materials surrounding or supporting the same, through blasting, the Contractor, at his own expense, shall remove such injured work and shall rebuild the same and shall replace the material surrounding or supporting the same, or shall furnish such material and perform such work or repairs or replacements as the Engineer/Architect may order. Any damage whatever to any existing structure due to blasting shall be promptly, completely, and satisfactorily repaired by the Contractor at his own expense.

3.5 SHEETING AND BRACING

- A. The Contractor shall furnish, install and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent any movement which can in any way injure the sewers, diminish the necessary width of the excavation, or otherwise injure or delay the work or endanger adjacent pavements, buildings or other structures.
- B. For sheeting and bracing which is specifically shown upon the drawings, or ordered in writing by the Engineer/Architect, to be left in place, the Contractor shall receive payment, in accordance with the General Conditions.

3.6 PROTECTION AGAINST WATER

- A. The Contractor shall do all pumping and bailing, build all subdrains and drains, and do all other work necessary to keep the trench and sewer clear of groundwater, sewage, or storm water during the progress of the work. Where the excavation for its depth is in whole or in part in wet sand, or where conditions warrant it, in the judgment of the Engineer/Architect, the Contractor shall install a pumping system connected with well points so as to drain the water from the water-bearing strata effectively.
- B. When existing sewers and laterals have to be taken up or removed, the Contractor shall provide and maintain temporary outlets and connections for all private or public drains, sewers, or catch basins, and he (she) shall take care of all sewage and storm water which will be received from

these drains and sewers and discharge the same; and for this purpose he (she) shall provide and maintain at his own expense an efficient pumping plant and temporary outlets; and be prepared at all times to dispose of the water and sewage received from these temporary connections, until such time as the permanent connections shall be made by the Contractor in a careful and workmanlike manner.

3.7 PIPE LAYING OPERATIONS (EXCEPT PVC)

A. General:

1. Sewer pipe shall, under all conditions, be laid in a dry-trench on an even, firm bed throughout the full length of the barrel so that no uneven strain will come on any pipe. The intent of the specifications is to maintain a dry trench and to properly bed the sewer pipe as shown on the Drawings. Pipe laying operations shall be carried on in a manner, which will insure against subsequent misalignment laterally and vertically; and to eliminate subsequent groundwater infiltration. The trench shall be kept continuously dry at all times, and the pipe bedded full length of the barrel so that a firm, even bearing will result for the bottom quadrant of the pipe as shown on the Drawings. Bell holes for bell and pipe shall be carefully made and be no larger than required to properly free the bell from bearing on the subgrade and to properly make up the pipe joints.
 - a. Protect pipe during handling against shocks and free fall. Remove extraneous material from the pipe interior.
 - b. Lay pipe by proceeding upgrade with the spigot ends of bell-and-spigot pipe pointing in direction of flow.
 - c. Lay each pipe accurately to the indicated line and grade, aligning so that the sewer has a uniform invert.
 - d. Before making pipe joints, clean and dry all surfaces of the pipe to be joined.
 - e. Use lubricants, primers, and adhesives recommended for the purpose by the pipe manufacturer.
 - f. Place, fit, join, and adjust the joints to obtain the degree of water tightness required.

B. Foundations and Bedding:

1. All sewer pipe shall be laid on a crushed stone bedding Type "A" or Type "C" granular cradle, having a minimum thickness of 6 inches below the pipe and extending around and up to the pipe as shown on the Drawings.
2. In trenches where a dry, firm subgrade cannot be maintained due to groundwater seepage into the trench, the subgrade shall be excavated to a depth of six inches below sewer pipe and shall be backfilled with crushed stone to form subdrain pipe bedding to the shape and dimensions as detailed on the Drawings. This will not be a pay item unless ordered by the Engineer/Architect to be placed at a depth greater than six inches below bottom of pipe.
3. When solid rock is encountered, the trench excavation shall conform to the shape and dimensions shown on the detailed Drawings and shall be backfilled with crushed stone or sand to form the pipe bedding.

C. Sewer Joints:

1. In general all sewer pipes shall be jointed in accordance with the recommendations and instructions of the pipe manufacturer.

2. At manholes a compression type polyurethane joint complying with ASTM Specification C-425 shall be used to join each influent and effluent line to the manhole as manufactured by Moorbase or equal. The sewer pipe shall be securely and completely encased in a metallic grout mortar through the opening in the wall. The metallic grout mortar shall be Embeco Grout Mortar by Master Builders; or equal.
3. Wherever dissimilar types of pipe are to be joined together outside of a manhole or other structure, the pipe shall be joined with suitable adapters, such as Fernco Couplings as manufactured by the Fernco Joint Sealer Co., Ferndale, Michigan 48220, or equal.

D. Existing Drains, Sewers, and Laterals:

1. Any existing drain or sewer not in conflict with the new work, which is disturbed or removed on account of the new work under this contract, whether shown on the Drawings or not, shall be restored or reconnected. Existing drains and sewers encountered in the work which are not in conflict with new work are, in general, to be restored by and at the expense of the Contractor, excepting that extensions thereof ordered by the Engineer/Architect and new portions of such old drains or sewers authorized by the Engineer/Architect, will be paid for at the contract prices for sewer of the same size, or as extra work. Connection to be made to the new sewer shall be made through tees, or wyes in the main.
2. Existing laterals, sewers or drains shall be restored with pipe of the same size and equal or better in type and quality. They shall be firmly supported across the trench by timbering, blocking, masonry, or other suitable manner to prevent after-settlement.
3. No existing sewers or drains shall be connected to the new sewer except as specifically shown on the Drawings or approved by the Engineer/Architect.

3.8 PVC PIPE INSTALLATION AND FIELD TESTING

A. Installation:

1. Pipe shall be installed in full compliance with the Recommended Practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe," ASTM Standard D 2321. In addition to the construction and testing procedures outlined in other sections of the specifications, the Contractor shall be required to install the pipe in such a manner so that the diametric deflection of the pipe shall not exceed 5% and the materials surrounding the pipe shall be compacted to the required Standard Proctor Densities outlined in D 2321. The area requiring compaction shall include the bed and sidefill material and also the material placed above the pipe for a distance of 6 inches over the top of the pipe. The Engineer/Architect may require up to 10 random compaction tests to be completed by an independent laboratory. If any of these tests indicate that the material has not been compacted to the required density, the Contractor shall recompact said material at no additional cost to the Owner, and the Engineer/Architect shall then have the right to require additional compaction tests to insure that this or other material is compacted to the proper density without any additional cost to the Owner.

B. Pipe Handling:

1. Care shall be taken during the transporting of the pipe to ensure that the binding and tie down methods do not damage or deflect the pipe in any manner. Pipe bent, deflected or otherwise damaged during shipping shall be rejected.
2. Pipe stored on the job site shall be covered with canvas or other opaque material to protect it from the sun's rays. Air circulation shall be provided under the covering.

3. PVC pipe shall not be removed from the pallet and/or laid out along the ditch until the bedding material is in place and ready to receive pipe. Only enough pipe should be laid out for one days' work.

C. Laying Pipe:

1. Lateral displacement of the pipe shall be prevented during embedment operations. Pipe shall not be laid in water, or under unsuitable weather or trench conditions.
2. Pipe laying shall begin at the lowest elevation, with bell ends facing the direction of laying except when reverse laying is permitted by the Engineer/Architect. Pipe jointing and installation shall be specifically in accordance with the manufacturer's recommendations except as otherwise specified herein, for the type used.

D. Backfill:

1. Backfill shall be placed in accordance with paragraph 3.9 below.

3.9 BACKFILLING TRENCHES

A. General:

1. After sewers are laid and bedded in open cut, the trench shall be backfilled to the original ground surface. Unless otherwise ordered, the backfilling shall not be left unfinished for more than three hundred (300) feet behind the completed pipe work.
2. As soon as the pipe is tested, the entire width of the trench shall be backfilled with material, as shown on the Trench Detail, and for the Case as shown in the plan and profile.

B. Backfill:

1. Case I:
 - a. In this case backfill, from the center line of the pipe to the surface shall be made by any acceptable method, which will not dislodge or damage the pipe or cause bridging action in the trench. Only selected excavation material, free from clods or stones, shall be used in backfilling up to 6" above the top of the pipe.
 - b. All trench backfill shall be compacted by jetting and watersoaking in the manner described below. The trench compaction shall be started at the point of lowest elevation of the trench and work up along the trench. Jetting and watersoaking shall not begin until the trench has been backfilled to within six (6) inches of the finished surface.
 - c. The holes through which water is injected into the backfill shall be centered over the trench backfill and at longitudinal intervals of not more than six (6) feet. Additional holes shall be provided if deemed necessary by the Engineer/Architect to secure adequate settlement. All holes shall be jetted and shall be carried to a point one (1) foot above the top of the pipe. Drilling the holes by means of augers or other mechanical means will not be permitted. Care shall be taken in jetting so to prevent contact with, or other disturbance of the pipe.
 - d. The water shall be injected at a pressure and rate just sufficient to sink the holes at a moderate rate. After a hole has been jetted to the required depth, the water shall continue to be injected until it begins to overflow the surface. The Contractor shall, at his own expense, bore test holes at such locations as the Engineer/Architect may designate in order to determine the effectiveness of the

water soaking. An approved soil auger shall be used for boring test holes. As soon as the jetting and watersoaking has been completed, all holes shall be filled with soil and compacted. Surface depressions resulting from backfill subsidence caused by jetting and watersoaking shall be filled and recompact by tamping or rolling to the satisfaction of the Engineer/Architect. The location where Case I is required shall be indicated on the Drawings.

2. Case IV:

- a. This case applies to those areas where, in the opinion of the Engineer/Architect, due to the nature of the soil or other factors, the use of jetting or watersoaking for compaction of the trench will not give satisfactory results. In this case, backfill material above the granular cradle to a point twelve (12) inches above the top of the pipe shall be placed in layers of six (6) inches thickness, loose measure, and each layer firmly compacted by ramming or tamping with tools approved by the Engineer/Architect in such manner as not to disturb or injure the pipe. The balance of the backfill material shall be placed in uniform layers of twelve (12) inches thickness, loose measure, and each layer shall be compacted by ramming or tamping with tools approved by the Engineer/Architect. All compaction under this case shall be not less than 80% optimum, modified proctor, for the soil. The location where Case IV is required shall be indicated on the Drawings.

3. Case V:

- a. This case applies to those areas where watermain, pipe sewers, or other conduits are crossing open areas where early settlement is not critical. In this case, backfill, from the center line of the pipe to the surface, shall be made by any acceptable method, which will not dislodge or damage the pipe or cause bridging action in the trench. Only selected excavated material free from clods or stones shall be used in backfilling up to six (6) inches above the top of the pipe. Water-soaking or other methods of trench settlement will not be required in this case. Excess material shall be neatly rounded over the top of the trench as directed by the Engineer/Architect to allow for settlement of the trench. In final clean-up operations, the Contractor shall reshape the surface to level out any uneven settlement that has occurred. The location where Case V is required shall be indicated on the Drawings.

3.10 MANHOLE CONSTRUCTION

A. General:

1. Manholes shall be constructed at the locations, to the depths, and of the materials, shown on the Drawings. Backfill shall be as shown on the Drawings and shall be compacted as specified for the sewer pipe backfill.
2. Concrete bottoms shall be carefully shaped to channelize and direct the sewage flow, as shown on the manhole detail on the Drawings.
3. All unused holes in the precast concrete rings shall be closed with concrete plugs and sewer joint compound.
4. Where the flow line grade of an incoming sewer is more than two feet above the flow line grade of the manhole, a drop connection shall be provided as shown on the Drawings.
5. Standard manholes shall be constructed and backfilled within 48 hours after sewer pipe is laid and drop manholes within 96 hours after sewer pipe is laid at the manhole location.

3.11 TEMPORARY SEWER CONNECTIONS

- A. Where special junction chambers or structures are to be constructed or where existing sewers carrying sanitary sewage and storm water are encountered, the Contractor shall provide and maintain temporary connections to prevent public nuisances and to prevent pollution. The costs of all such temporary connections, pumping and diversions shall be considered incidental to the scope of work. No separate payment will be made for such or similar items of work. No such existing sewers shall be connected to the new sewers unless shown on the Drawings or approved by the Engineer/Architect and/or the Owner.

3.12 SEWER PIPE AND WATER MAIN SEPARATION

- A. Sanitary sewers, house sewers or storm drains that are laid in the vicinity of pipe lines designated to carry potable water shall meet the following conditions.
 - 1. Parallel Installation – Sewers and Water Mains:
 - a. Normal Conditions - Any sanitary sewer, storm sewer or sewer manhole shall be located at least 10 feet horizontally from water mains, whenever possible; the distance shall be measured from edge to edge.
 - b. Unusual Conditions - When local conditions prevent a horizontal separation of 10 feet, a storm or sanitary sewer may be laid closer to a water main provided that:
 - 1) The bottom of the water main is at least 18 inches above the top of the sewer.
 - 2) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction for 10 feet measured perpendicular on either side of the water main.
 - 2. Crossings – Sewers and Water Mains:
 - a. Normal Conditions - Water mains crossing house sewers, storm sewers or sanitary sewers crossing water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer.
 - b. Unusual Conditions - When local conditions prevent a vertical separation as described above, the following construction shall be used.
 - 1) Sewers passing over or under water mains should be constructed of the materials equivalent to Watermain Standards.
 - 2) Construction of sewers crossing over water mains shall insure additional protection to the water main by providing:
 - a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;
 - b) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;
 - c) That the length of watermain type sewer pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

3.13 CLEANING, INSPECTION AND TESTING

A. Cleaning and Maintenance:

1. Special care shall be taken during the construction of the sewers to prevent rubbish of every kind and description, and especially sand, from entering or remaining in the sewers. As the construction of the system approaches completion, the Contractor shall systematically and thoroughly clean and make any needed repairs to the entire length of the sewers. He (she) shall furnish, at his own expense, suitable tools and labor for cleaning out all dirt and foreign substances from the sewers, and, if necessary, water for cleaning the sewers by flushing. The cleaning and the repairs above described shall be arranged as far as practicable to be completed upon the finishing of the whole construction work. The Owner will make, upon the completion of the cleaning operations, final inspection of the work.

B. Inspection:

1. The sewer shall be subject to inspection at such times as the Engineer/Architect may direct. All repairs necessary by the inspection shall be made. Broken or cracked pipe shall be replaced; defective joints, if any, replaced; all deposits removed; and the sewer left true to line and grade, entirely clean, free from lumps of protruding jointing material, etc., and ready for use. Each section of sewer between manholes shall show, upon examination from either end a reasonably full circle of light.

C. Testing:

1. Air Testing – General:

- a. The proposed sanitary and force mains will be tested for acceptability by the air testing technique. Special attention of the Contractor is directed to the requirement that all pipe laying will be permitted only in dry trenches having a stable bottom, inasmuch as it is imperative that all sewers and manholes be built practically or reasonably watertight and airtight. The Contractor must adhere rigidly to the specifications for materials and workmanship covering sewer construction. After completion, the sewers or sections thereof shall be tested with a low-pressure air test, which is a test to determine the rate at which air under pressure escaped from an isolated section of sewer. The rate of air loss is intended to indicate the presence or absence of pipe damage and whether or not the joints have been properly constructed. This test is not intended to indicate water leakage limits. In applying the low-pressure air test to sanitary sewers several factors should be understood and precautions followed during the test.
- b. Plugs should be securely braced to prevent the unintentional release of a plug, which can become a high velocity projectile. Plugs should not be removed until all air pressure in the test section has been released.
- c. For safety reasons, no one should be allowed in the trench or manhole while the test is being conducted.
- d. The testing apparatus should be equipped with a pressure relief device to prevent the possibility of loading the test section with the full compressor capacity.
- e. The pipe should be tested in a wet condition if at all possible.

2. Low Pressure Air Test:

- a. Provide necessary labor and equipment to test the proposed sewer extension by means of a low-pressure air test as set forth in The Standard Specifications for

Water and Sewer Main Construction, latest Edition. Test each section manhole to manhole to determine its tightness. Should a section not pass the air test as set forth in the above specification, the Contractor will locate the defect and repair the leak. The ultimate responsibility for ensuring that the proposed sewer does perform according to the specification will be with the Contractor.

3. Air Testing – Procedure:

- a. The section of the sewer to be tested shall be backfilled and cleared, and plugged at each end by means of inflatable stoppers, securely braced to prevent possible blow-out due to the internal air pressure. The pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested and then shall be inflated to 25 psig. Air is then added to the test section until the internal air pressure is raised to 4 psig above the average back pressure of ground water over the sewer pipe, and the air pressure shall be allowed to stabilize for at least 10 minutes and a maximum of 30 minutes.
- b. After the stabilization period, the pipe in the test section shall be pressurized to 3.5 psig and the time in minutes measured for the pressure to drop to 2.5 psig. If ground water is present, the air pressure in the line shall be increased to 3.5 psig above the level of the ground water and the drop of one pound of air pressure measured in minutes. The section being tested should be deemed acceptable when the time taken for the one (1) pound pressure drop is not less than that shown in the table below.

TABLE 1 from ASTM Designation: C 1244
Minimum Test Times for Various Manhole Diameters in Seconds

Depth (ft)	Diameter, in.								
	30	33	36	42	48	54	60	66	72
	Time, in seconds								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

4. Time Limits for Loss of Air Pressure:

- a. The loss of air is acceptable and the line is considered to be reasonably free from defects, if the time in minutes and seconds for the pressure to go from 3.5 psig to 2.5 psig is not less than the time per inch of pipe diameter per length of sewer pipe as shown in the table above.

3.14 PVC PLASTIC PIPE TESTING

A. Air Testing:

1. The PVC sewer main shall be tested for acceptability by the air testing technique as specified above in Cleaning, Inspection and Testing.

B. Deflection Testing for Flexible Conduit:

1. The project engineer/architect shall randomly select portions of the project to be deflection tested. Such portions shall consist of the manhole intervals in the initial 1200 feet of sewer and not less than 10% of the remainder of the sewer project.
2. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the base diameter of the pipe as established in proposed ASTM D-3034. The test shall be performed without mechanical pulling devices.
3. The individual lines to be tested shall be so tested no sooner than 30 days after they have been installed.
4. Wherever possible and practical, the testing shall initiate at the downstream lines and proceed towards the upstream lines.
5. No pipe shall exceed a deflection of 5%.
6. In the event that the deflection exceeds the 5% limit in 10% or more of the manhole intervals tested, the total sewer project shall be tested.
7. Where deflection is found to be in excess of 5% of the original pipe diameter, the contractor shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found. The line shall then be retested for deflection. However, if after the initial testing the deflected pipe fail to return to the original size (inside diameter) the line shall be replaced.

C. Final Cleaning:

1. Upon completion of all testing, the Contractor shall clean the PVC sewer in such a manner as to ensure that no foreign matter or debris has been left in the sewer. All foreign matter and debris shall be removed and disposed of in a manner acceptable to the Engineer/Architect.

3.15 RESTORATION OF SURFACE AREAS

A. General:

1. After backfilling operations are completed, surface areas shall be replaced or restored as called for on the Drawings, which in general shall be to a condition equal to that existing prior to start of work. In areas with Case V backfill, the top of the trench shall be completed as shown on the Trench Detail, or reshaped once by machine with the backfill being left slightly mounded, not over 12 inches, above natural ground surface. Restoration shall not be done sooner than thirty (30) days after the backfill is placed.
2. All pavements and sidewalks shall be replaced to a condition equal to that previously existing and as shown in typical detail on the Drawings. A minimum compacted base of eight (8) inches of crushed stone or gravel shall be provided. Bituminous surfaces shall be replaced with 2" minimum thickness bituminous concrete surface course Class I with a minimum compacted base of eight (8) inches of crushed stone or gravel.
3. At streets, street intersections, driveway entrances, and at any other pavement location disturbed during construction, the Contractor shall place crushed stone surfacing to maintain traffic.
4. In general the Contractor shall confine his damage of improved surfaces to a minimum, and any unnecessary damage shall be replaced by him (her) at his entire cost and expense. The Engineer/Architect shall determine what damage is unnecessary and his judgment shall be final.

B. Seeding:

1. The grass surface area disturbed during construction shall be seeded for the complete width of disturbed area in accordance with the applicable articles of the Missouri Department of Transportation, "Standard Specifications for Highway Construction."
2. The Contractor shall maintain the seeded area, watering, reseeding, patching, etc., as necessary, until a satisfactory acceptable stand of grass is obtained. Damage resulting from erosions, gullies, washouts, shall be repaired by filling with top soil, tamping, and reseeding, by the Contractor at his expense, if such damage occurs prior to final acceptance.
3. Seed mixture shall be in accordance with Section 329219.

3.16 MARKER TAPE

- A. An electrically detectable metalized foil marking tape shall be installed with the sewer main and laterals to facilitate locating the sewer with an electronic pipe finder. The marker tape shall consist of a 5.5 mil composition film containing one layer of metalized foil laminated between two layers of inert plastic film formulated for prolonged underground use, and shall be resistant to alkalis, acids and other destructive agents found in the soil. The tape shall be safety green in color, 3" wide, and shall bear a continuous message printed in permanent ink warning of the underground installation.
- B. Installation shall be continuous along the centerline for the full length of the sewer line and shall be installed at a depth of 2 to 3 feet.
- C. Installation shall be for all service laterals, and sewer mains where the manholes are buried. In lines with buried manholes, run tape from downstream exposed manhole, above sewer line and all buried manholes, to upstream exposed manhole.
- D. The tape shall be "Detectable Terra Tape" as manufactured by Reef Industries, Inc., Houston, Texas, or equal.
- E. No separate payment will be made for marker tape.

3.17 BORING AND ENCASEMENT

- A. At locations shown on the Drawings, the sewer pipe shall be ductile iron with steel encasing pipe installed in a bored hole.
- B. Bore holes shall be made in advance of the sewer construction so that, if necessary, minor adjustments can be made in alignment and grade with the approval of the Engineer/Architect. Bore pits shall be backfilled and compacted for settlement. See Drawings for backfill Case.
- C. Casing pipe shall be pushed through the embankment without use of pilot by the Boring-Jacking Method. This method utilizes an auger operating inside the pipe to carry out dirt, but not to cut in advance of the pipe itself.
- D. Where traffic must be maintained, the operations shall be carried on without encroachment upon the traveled way by either the excavation or by the storage of equipment or materials. Adequate sheeting and bracing shall be provided if the nature and condition of the soil or height of exposed faces is such as to endanger either the traveling public or the integrity of the road surfacing. Construction shall be in accordance with required permits for the work.

3.18 GUARANTEE

- A. The Contractor shall guarantee all materials and workmanship furnished, and shall replace or repair any damage due to settlement of backfill in trenches or pavement for a period of one (1) year from date of acceptance.

END OF SECTION 334101

APPENDIX 1 – GEOTECHNICAL REPORT

THIS PAGE INTENTIONALLY LEFT BLANK

November 12, 2020

20-5033

Office of Administration-Division of Facilities Management, Design, and Construction
730 Truman Building 301 West High Street
Jefferson City, MO 65102

Attn: Mr. Craig Bock

RE: Geotechnical Investigation – ISTS New Fitness Center

Dear Mr. Bock:

In accordance with your request we have completed a geotechnical investigation for the ISTS New Fitness Center at the Jefferson City Missouri National Guard site.

Scope of Services

The scope of our geotechnical services for this project consisted of investigating the site's subsurface conditions by drilling four (4) test borings at the proposed site; two (2) borings for the proposed building and two (2) borings for the proposed parking lot and drive. The test borings were drilled to depths of 6½ to 21½ feet (elev. 588.3 to 601.7) below the existing ground surface. The boring locations were staked and graded by our firm and the locations are shown on the test boring location image in the appendix to this report. Ground surface elevations were determined by referencing the top flange bolt for the fire hydrant at the southwest corner of the intersection of North Boundary Road and Military Drive (BM#1) at reported elevation 604.65 and are indicated on the enclosed boring logs. The scope of services also consisted of a laboratory testing program and an engineering analysis of the soil-structure interaction with subsequent foundation, slabs on grade, backfill, subgrade, and related site earthwork recommendations.

Site Description

The proposed ISTS New Fitness Center will be located at the existing facility on the south side of the road at 6819B N. Boundary Road. The site is south of the south bank of the Missouri River in the upland hills area of Jefferson City, Missouri. The building location is situated between N. Boundary Road and an existing paved parking lot, in a filled area, and is moderately sloping and draining to the east/northeast. The site is covered in lawn area and landscaping trees with ground surface elevations at the borings ranging from 605.7 to 610.1.

Site Geology

In the vicinity of the proposed site, the building location consists of recent fill overlying loessial soils. The loessial soils were deposited by the prevailing winds and, in general, consist of an upper mantle of lean clays that is underlain by softer seams of lean clays and silts. This area of Cole County in central Missouri adjacent to the Missouri River in the upland hills area is contained in the Salem Plateau Section of the Ozark Plateaus Province of the Interior Highlands Physiographic Division. The loessial deposits are underlain by residual soils and Ordovician Age weathered bedrock.

The area is characterized by rolling narrow ridge tops, moderately to steeply rolling grass and tree covered ridge tops and hills, moderate to steep valley slopes, lowlands, and bluffs, intersecting the flood plain of the Missouri River and its tributaries with the heaviest areas of timber found on the hill tops and alongside creeks and rivers. The drainage features in this area of Cole County are dendritic in structure and regionally the area flows to the east toward the Mississippi River confluence.

Proposed Development

We understand that the ISTS New Fitness Center will be an approximately 6,000 square foot climate controlled, pre-engineered structure. A parking lot and drive area is proposed between the roadway and existing parking lot. The building will include a fitness area, building systems and locker room areas. We understand the building will utilize a combination of bearing walls and isolated column footings for support and the finish floor elevation is not set but has been reported to be between elevation 616 and 617; therefore, structural fills in the building area should be up to approximately 8 feet. We understand that the structure will have relatively light foundation reactions; therefore, our geotechnical engineering analyses considered maximum bearing wall loads of up to 1.5 kips per foot and maximum isolated column loads of up to 20 kips. If our understanding of the new construction addition or any of our estimates and/or presumptions do not accurately represent this project, we should be notified to provide a revision to this report.

Subsurface Conditions

The results of the geotechnical investigation indicated that the proposed ISTS New Fitness Center north of Jefferson City, Missouri is covered by recent fill/disturbed soil from previous site construction fill and natural soil deposits of loessial origin. Topsoil thickness at the borings ranged from approximately 6 to 9 inches. Recent fill was encountered in borings B1 and B3. Below the topsoil the recent fill/disturbed soil was composed of brown and light gray, stiff to very stiff, lean clay (CL). N values in the fill ranged from 9 to 12 blows per foot and unconfined compressive strength values varied from 1.65 to 2.62 T.S.F. on select samples. Spring penetrometer strength estimate readings varied from 1.5 to 2.0 T.S.F. and moisture contents in the fill ranged from 19.1% to 22.9%. Discernment of fill soils of like composition to the natural soil profile can be difficult; we believe the possible fill was encountered in the borings to depths of approximately 3½ to 5 feet (elev. ±600½ to 606½) below the surface.

Below the recent fill, natural reworked loess was encountered and was composed of yellow brown, brown, light brown, light gray and gray mottled lean clay (CL) and silt (ML). These soils were very soft to very stiff in consistency and very loose to loose in apparent relative density with N values ranging from 1 to 10 blows per foot and unconfined compressive strengths on selected samples varying from 0.50 to 1.47 T.S.F. Spring penetrometer compressive strength estimates varied from 0 to 2.5 T.S.F. with moisture contents ranging from 24.1% to 41.9%. The borings terminated in the loessial soils at completion depths of 6½ to 21½ feet (elev. 588.3 to 601.7) below the ground surface.

Groundwater Observations

Observations to determine the apparent presence of groundwater were conducted during drilling and at completion of the borings. The groundwater levels at the borings were as follows:

Boring No.	Groundwater Depth/Elev. During Drilling	Groundwater Depth/Elev. @ Completion	Groundwater Depth/Elev. @ Hrs. after completion
1	15/594.8	11/598.8	11/598.8 @ 1½ hrs.
2	15/595.1	12/598.1	11/599.1 @ ½ hr.
3	Dry	Dry	n/a
4	Dry	Dry	Dry @ ½ hr.

These measurements indicate that static water levels and/or perched groundwater are generally below the expected depths of excavation. Due to the composition of the soils at the site, it is expected that perched or trapped groundwater can be found at depths above these measurements. If excavations of more than approximately 6 feet below the existing ground surface are anticipated to be open for an extended amount of time, a dewatering program should be considered. In view of the low permeability of the soils at the site, dewatering of perched groundwater and/or trapped surface water from shallow, temporary excavations can typically be accomplished by pumping from sump pits.

Geotechnical Engineering Analyses and Foundation Recommendations

The results of the geotechnical investigation indicate that the proposed ISTS New Fitness Center project may be supported by shallow reinforced concrete foundations based in the natural soils and/or new structural fill soils. Continuous bearing wall footings may be proportioned for a maximum net allowable soil pressure (FS=3) of 1,500 P.S.F., while spread footings may be proportioned for a maximum net allowable soil pressure (FS=3) of 2,000 P.S.F. The net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Spread footings should be a minimum of 36" in the least dimension, while continuous bearing wall footings should be a minimum of 24" wide. Total settlements of foundations proportioned as recommended should be less than approximately 2" while differential settlements between adjacent foundation elements should be less than about ½". Exterior footings and footings in unheated areas should be based at least 30 inches beneath the finished exterior grade for frost protection. A summary of the foundation recommendations is shown below:

Description	Continuous Bearing Wall Footings	Isolated Column Footings
Net Allowable Soil Pressure	1,500 PSF	2,000 PSF
Minimum Width, in.	24"	36"
Recommended Founding Depth	30" below Finished Exterior Grade	Nominal Depth Interior, 30" below Finished Exterior Grade
Coefficient of Sliding Friction	0.35	

Unsuitable (soft or unstable) soils and any unsuitable recent fill (if encountered), should be removed from the footing excavations, and consequently replaced with suitable material as recommended below. For spread footings the depth of overexcavation should be at least 3 feet or to suitable soil, whichever is shallower and at least 33% wider than the design width for lateral stress dissipation. For bearing wall footings, the over-excavations, if needed, should extend to at least 2 feet or to adequate bearing material, whichever is shallower, and should be at least 50% wider than the design width for lateral stress dissipation. Once the limit of the overexcavation is reached, the exposed surface should be compacted with suitable compaction equipment prior to backfilling.

Replacement material (if required) for unsuitable soils in the footings may consist of suitable granular material that is placed in 8" or less lifts and compacted to at least 95% of the standard proctor maximum dry density (ASTM D 698) or flowable fill (Controlled Low Strength Material, CLSM). If flowable fill or lean concrete is utilized for backfill then the recommendation for overwidening the overexcavation is not necessary. Observation by a geotechnical engineer is recommended at the time of excavation to determine the presence and competency of the expected bearing strata and to document removal of unsuitable soils, if encountered. We suggest that a unit price be obtained for overexcavation and replacement prior to construction in the event that remediation is required during the foundation construction phase of the project. If changes are made to the grading plan differing from the reported/presumed plan at the time of this report, we should be consulted to review how the changes may impact our recommendations.

Footing excavations should be made to the required lines and grades as rapidly as possible. We recommend that footing excavations be left open for a minimum of time to prevent disturbance to the foundation soils. Foot traffic should be prevented on the base of the footing excavations if disturbance is noted. Hand cleaning, if required and setting of reinforcing steel should then be accomplished from the sides of the excavation. Surface drainage and gutter/roof drainage from the existing building should be diverted away from the construction area during construction activities.

Based on the soils encountered in the borings and our interpretation of site conditions, the lateral footing capacity, due to base shear, should be calculated using an allowable coefficient of friction between the base of the footing and the soil of 0.35. Passive resistance is formed as an object (shear key, footing, pile cap, etc.) plows through the soil. All calculations of passive resistance are based on the condition that the soil on the passive side of the footing will always be present. If at some future time, some of the soil on the passive side is removed, the passive resistance will decrease. Therefore, the possibility of some soil being removed should be considered when determining passive resistance to lateral loads.

If a minimum of 3 feet of soil is present, an equivalent fluid pressure of 220 pounds per cubic foot may be used to calculate the net allowable passive soil resistance. For less than 3 feet of soil passive resistance should not be used. The ground surface adjacent to the wall or footing should be horizontal in the direction of movement to a distance equal to at least twice the embedment depth. If the ground is sloped downwards away from the structure, a reduced equivalent fluid pressure should be used.

Floor Slab and Site Earthwork Recommendations

Topsoil should be removed from the subgrade and fill areas prior to the commencement of earthwork activities and stockpiled for possible use for finished topsoil grading, if desired. Prior to the placement of structural fill and/or floor slab construction the subgrade in the building area should then be compacted to a dry density of at least 95% of the standard (ASTM D 698) proctor maximum dry density and within a moisture content range of 2% below to 4% above. Subgrades in fill areas should undergo the proofrolling/compacting process. Soft and/or unstable areas revealed by the proofrolling/compacting process should be excavated, reworked, and then be recompacted or removed and replaced with suitable material as necessary. Granular material, if used, should be composed of reasonably well graded crushed stone or gravel with a maximum size of about 1" and not more than 15% non-plastic fines. If high plastic clays are found during excavation within 2 feet of the bottom of the floor slab, the high plastic clays should be removed and replaced with suitable material following the recommendations below.

We recommend that structural fill material required for establishment of final grade in the building area be placed in 6" to 8" lifts and compacted to at least 95% of the maximum dry density as per ASTM D 698 or to at least 80% of the maximum relative dry density as per ASTM D 4253 and D 4254, if cohesionless. Structural fill material may consist of lean clay (LL=45% or less and PI=25% or less) or granular material. The moisture content should be kept within 2% below to 4% above optimum. Field density tests, in fill and natural subgrades, should be conducted at the rate of one test per 2,500 square feet per lift and one test per 100 linear feet of wall backfill per lift. A summary of the compaction recommendations follows:

Compaction Recommendations		
Description	ASTM D 698	Moisture Content
Building Subgrades (Top 12")	95%+	-2% to +4%
Structural Fill/LVC	95%+	-2% to +4%
Footing Overexcavation Backfill	95%+	±2%

The upper portion of the subgrade may be wet of optimum depending on the time of year. Consequently, additional effort may be required to re-work and recompact the soils within the zone of seasonal moisture variation. Floor slabs should be provided with adequate crack control joints and separated from the foundation system to accommodate vertical slab movements due to minor volume changes in the subgrade. The floor slab should also be provided with a layer of free draining granular base such as crushed limestone and it should not contain more than 5% fines. We further recommend that a polyethylene moisture barrier be provided between the granular base and floor slab to reduce moisture transmission through the concrete floors and to reduce the potential for concrete curling.

The site grading plan should provide for positive surface water drainage away from the proposed new structure and roof drains should connect to watertight lines that extend away from the buildings. All drain or utility lines beneath floors should have tight joints to prevent leakage. Large trees and shrubs should not be planted adjacent to exterior footings, as these plants can cause drying and shrinkage of foundation soils.

Temporary Excavations

Temporary excavations should be constructed in accordance with OSHA regulations. The soils at the site classify as OSHA Type B soils according to our borings and excavations extending less than 20 feet in vertical height into these soils should be cut on a slope no steeper than 1H:1V. Flatter slopes may be required and all operations should be performed under the supervision of qualified site personnel in accordance with OSHA regulations. Excavations deeper than 20 feet must be designed by a registered professional engineer and, based on our understanding of the project are not anticipated. Excavation slopes left exposed should be protected from erosion and saturation by rainfall and runoff.

Pavement Subbase Recommendations

We presume that the pavement section(s) will consist of either flexible (hot-mix asphalt) or portland cement concrete over a compacted aggregate base course and compacted soil subgrade. The subbase for all paved areas should be thoroughly proofrolled and compacted to a depth of at least 12" and to a minimum dry density of 98% of the maximum dry density as established by ASTM D 698 and within a moisture content range of $\pm 2\%$ of optimum.

We further recommend that the granular base under the pavement be compacted to a minimum density of 98% of the maximum dry density (ASTM 698) and the moisture content should be controlled within a range of $\pm 2\%$ of optimum. Pavement subgrades should undergo the proofrolling process to help in identifying soft or unstable areas; remediation should follow our previous recommendations. We recommend a bearing ratio (CBR) of 2% may be used in design of pavement sections founded in natural, on-site soils prepared and compacted as recommended herein. During proofrolling, permanent rutting in excess of 1 inch should be considered failure. Elastic (rebound) movement or rutting in excess of 1 inch with substantial cracking or substantial lateral movement should be considered failure. Rutting and cracking greater than detailed above is considered "pronounced elasticity". Elastic, rebound, or rolling movement is always associated with excess water in the subgrade system. Failing areas detected by proofrolling should be removed and replaced with suitable material as previously recommended. Areas of pavement subgrades that do not respond to proofrolling and recompaction may be amended by the use of chemical admixtures and/or commercially available subgrade reinforcing geogrids such as Tensar® TX 140/160. The aggregate base course should conform to the gradation requirements similar to MODOT Type 5 gradation.

We recommend the use of a geogrid beneath the granular base in order to provide separation and reinforcement if utilizing a flexible pavement design. Tensar® TX 7 or equivalent would be suitable for this application and it will reduce the amount of overexcavation resulting from subgrade instability. Manufacturer's guidelines suggest that at least 6 inches of aggregate base be used above the geogrid. If rigid pavement is selected we recommend the use of a geotextile fabric beneath the granular base in order to improve subgrade drainage and to provide separation and drainage from the underlying fine-grained soils. Mirafi 160N or equivalent would be suitable for this application. We recommend following the manufacturer's guidelines for installation and overlap procedures.

It should be noted that some of the subgrade soils may be wet of optimum dependent upon the time of year during construction. Therefore, reworking and recompaction may be necessary and may require considerable effort. Consideration should be given to heavy-duty concrete pavement at entrances, near trash dumpsters, loading docks and/or areas of repeated truck traffic. We recommend drains be provided around catch basins and low parts of the roadway to minimize the accumulation of water in the subgrade soils. Proper slope of the pavement subgrades and pavement surfaces to achieve adequate drainage is crucial in pavement life span. Regular maintenance should be performed on the pavement surfaces to reduce the potential deterioration due to moisture infiltration through surface cracking.

Seismicity

Based on the subsurface conditions encountered and areal geology, the site class is C in accordance with IBC 2015. Seismic site classification is based on soil data in the top 100 feet below grade. The calculated site-modified spectral acceleration value $S_{ms} = 0.244$ and the calculated site-modified spectral acceleration value $S_{m1} = 0.181$. Liquefaction potential for the site is relatively low, although some vertical and horizontal displacement should be expected during a major earthquake.

Conclusions

The geotechnical investigation, including exploration, testing, and analyses has been completed for the proposed ISTS New Fitness Center at 6819B N. Boundary Road in Jefferson City, MO. Foundation, slabs on grade, subgrade, backfill, and related site earthwork recommendations, based on the investigation, have been included in this report. The analyses, conclusions and recommendations contained in this report are based on the site conditions and project descriptions presented in this report, and the subsurface conditions disclosed by the exploratory borings. The conclusions and recommendations presented are professional opinions based on the above conditions, professional judgment and experience.

If during design and construction, changes occur, either in the proposed construction, due to natural causes or construction operations at the site, from a substantial lapse in time, or should subsurface conditions encountered during construction differ materially from those presented, we should be contacted to review any changes in circumstances and conditions to evaluate the effects on the analyses, conclusions and recommendations presented.

The borings were placed to obtain a reasonable picture of the subsurface conditions. However, variations in the subsurface conditions not indicated by the borings are always possible. These data are supplied for the benefit of the designers and owner and do not express or imply any warranty of the subsurface conditions. Completed foundation excavations, foundation construction, site grading, backfill and pavement construction should be observed and tested during the construction phase by a qualified professional to verify the subsurface conditions and the design assumptions.

The scope of our services does not include environmental assessment of investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater or surface water within the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our clients.

As always, if you have any questions do not hesitate to contact us.

Sincerely,

GEOTECHNICS, A DIVISION OF KLINGNER



Brian Joseph Sick, P.E.
Missouri P.E. No. 2005022155



Encl.

A P P E N D I X

TEST BORING LOCATION SKETCH
FIELD INVESTIGATION
LABORATORY INVESTIGATION
BORING LOGS - GENERAL INFORMATION
BORING LOGS

ISTS New Fitness Center

20-5033: 6819B N. Boundary Road, Jefferson City, MO

B1: N38 33 14.1, W92 4 25.0

B2: N38 33 13.6, W92 4 23.9

B3: N38 33 14.1, W92 4 23.2

B4: N38 33 13.3, W92 4 23.2

Legend

- BM1
- Soil Boring Locations



FIELD INVESTIGATION

The field investigation consisted of site observation, subsurface exploration and sampling, as well as field testing and visual classification of the soils encountered in accordance with ASTM specifications. The site observation provided information concerning existing topography and recent manmade alterations, if any were observed. During the investigation the locations and ground elevations for each of the borings were determined, unless provided by others. Subsurface exploration and sampling was conducted in an effort to define the soil profile and to obtain disturbed and/or undisturbed representative samples of the various soils encountered for the purpose of the laboratory investigation.

Dependent upon the field conditions and project requirements, test borings were completed with a CME 75 truck mounted or CME 55 track mounted drill rig equipped with either 3¼ or 4¼ inch I.D. hollow stem augers in accordance with ASTM D6151, 5 inch solid stem augers in accordance with ASTM D1452, or rotary drilling equipment in accordance with ASTM D5783. The hollow stem augers permit convenient access to the undisturbed soil below the auger bit which allows the driller to obtain a soil sample at the desired depth. The boreholes upon completion were backfilled with auger cuttings (soil) and boring plug (if requested). Periodic observation and maintenance of the backfilled boreholes should be performed to monitor for subsidence at the ground surface as the borehole backfill could settle over time.

As the test borings were advanced, methods of sampling were employed to recover soils from the undisturbed strata below the auger bit. Representative disturbed samples were obtained from a standard Split Spoon and the samples were recovered by driving a 2 inch O.D. (1 3/8 inch I.D.) Split Spoon sampler in accordance with ASTM D1586. When subsurface conditions warranted, relatively undisturbed samples were obtained in cohesive soils by hydraulically pushing a thin walled seamless tube sampler into the soil in accordance with ASTM D1587. The Shelby Tubes were 2 or 3 inches in outside diameter depending upon the project requirements. One or both of these methods may have been utilized based on site conditions and/or job specific requirements. Additionally, disturbed samples collected from auger cuttings in accordance with ASTM D1452 may have been obtained as needed to further facilitate identification of the subsurface conditions.

The recovered samples were described in the field according to color, texture, grain size, plasticity and consistency, as recommended by ASTM D2488, "Description and Identification of Soils (Visual-Manual Procedure)". Split Spoon samples when obtained were sealed/preserved in glass jars and labeled while Shelby Tube samples, when obtained, were sealed/preserved within the tubes and also labeled prior to transporting to our laboratory. Auger cuttings, when obtained, were sealed in an air tight container to preserve the natural moisture content. The samples were all carefully stored, preserved, and transported for later use in the laboratory testing program in general accordance with ASTM D4220.

Field tests were conducted in an effort to estimate the shearing strength of the soil. Though the results of these tests were not used alone as a basis for shearing strength determination, they were helpful in predicting the behavior of the soil mass and should only be considered an approximate estimation. Where applicable, further laboratory testing and evaluation in conjunction with the field testing program was essential in determining the soil conditions.

The field testing program included the Standard Penetration Test conducted in accordance with ASTM D 1586. In this test, administered during the Split Spoon sampling procedure, a 2 inch O.D. (1 3/8 inch I.D.) 24 inch long standard Split Spoon was driven into the soil through a depth of 18 inches by a 140 pound weight dropped a distance of 30 inches. The penetration resistance, "N", was recorded as the number of blows, from the falling weight, required to drive the sampler through the final 12 inches. This penetration resistance provided a measure of the apparent relative density of cohesionless soils and an estimate of the consistency of cohesive materials.

Recovered cohesive samples were tested, when possible, by the use of a calibrated pocket penetrometer. The values from this test were considered an approximate measure of the consistency of the cohesive soils. The penetrometer values as well as the measures of penetration resistance were later correlated with the results of the laboratory tests conducted on cohesive soil samples obtained from the Split Spoon and/or Shelby Tube samples.

The results of the field tests on each soil sample, as well as the soil descriptions, were recorded on field boring logs in accordance with ASTM D 5434 as the subsurface exploration progressed. These field boring logs were later modified to reflect the more elaborate analysis provided by the laboratory testing program. These modified field boring logs are the final boring logs that are attached to this report.

LABORATORY INVESTIGATION

The laboratory investigation involved the completion of classification tests on select undisturbed samples as well as select disturbed samples of the soils that were obtained from the various soil layers encountered beneath the site. Based on the field logs/records and our examination of the samples in the laboratory, a soil testing program was developed to acquire more precise estimations and detailed information about the soil conditions at the site.

Representative samples from the various soil strata were tested (site specific determination) in accordance with ASTM specifications. Dependent upon the sample availability and project requirements the laboratory testing on select representative samples included such soil index testing as natural moisture content (ASTM D2216), atterberg limits testing (ASTM D4318) and grain size analysis (ASTM D422). These parameters were used in identifying the soils through the Unified Soil Classification System in accordance with ASTM D 2487. This System, which is standardized and widely accepted, enables the Geotechnical Engineer to classify a soil using quantitative test results. A brief description of this classification system is contained in this report. Estimated predictions of the soil behavior during and after construction may readily be made through the use of this comparative type of classification.

Disturbed Split Spoon and/or relatively undisturbed Shelby Tube samples of cohesive soils were tested to determine unit weight and an approximation of the unconfined compressive strength. These tests were conducted with controlled strain by the use of a hand-operated compression apparatus with a double proving ring in accordance with ASTM D 2166. The results of some of the tests must be considered cautiously, recognizing that Split Spoon samples are disturbed and when tested, will generally provide slightly conservative values in relation to the probable conditions in the field. The relatively undisturbed Shelby Tube samples, however, should approach more closely the condition of the soils in-situ and the results of unconfined compression tests on these samples are typically considered to be fairly indicative of the in-situ soil conditions. When indicated, the undrained shear strength of saturated fine-grained soils was estimated utilizing the miniature vane shear test in accordance with ASTM D4648.

Additional laboratory testing in accordance with ASTM standards such as specific gravity, moisture-density relationship, relative density, hydraulic conductivity, consolidation, direct shear, triaxial compression, among others, are utilized when applicable for project specific requirements. Upon completion of the laboratory testing program the final boring logs were prepared utilizing the data obtained from the laboratory testing and the initial data/records contained on the field boring logs. The remaining soil samples after the project testing is completed will be held for a minimum period of one month. After one month, the samples are typically discarded unless prior notification is provided to us.

B O R I N G L O G S

GENERAL INFORMATION

I. DRILLING AND SAMPLING SYMBOLS:

- HA - Hollow or Solid Stem Continuous Flight Auger Disturbed Samples
- SS - Split Spoon Sample (2" O.D. - 1 3/8" I.D.) Obtained Following the Standard Penetration Test
- 2ST - Shelby Tube Sample (2" O.D.)
- 3ST - Shelby Tube Sample (3" O.D.)

II. SOIL IDENTIFICATION:

The soils have been identified by Visual-Manual procedures in accordance with ASTM Standards (ASTM D 2488). Where specifically noted, the soils have been classified using the Unified Soil Classification System (ASTM D 2487). Classification estimates are in parentheses when applicable.

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of Components Present in Sample by Percent of Dry Weight

Trace	< 15
With	15-29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of Components Present in Sample by Percent of Dry Weight

Trace	< 5
With	5-12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample and Size Range

Boulders	Over 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to #4 sieve
Sand	#4 sieve to #200 sieve
Silt or Clay	Passing #200 sieve

SOIL STRUCTURE TERMINOLOGY

Parting:	Paper Thin in Size
Seam:	1/8" to 3" in Thickness
Layer:	Greater than 3" in Thickness
Interbedded:	Alternating Soil Type Layers
Laminated:	Thin Layers of Varying Color and Texture, or Composition
Slickensided:	Having Inclined Planes of Weakness that are Slick and Glossy in Appearance
Fissured:	Containing Shrinkage Cracking, Frequently Filled with Fine Sand or Silt, Usually Vertical
Ferrous:	Containing Appreciable Iron
Desiccated:	Soil that has been Subjected to a Thorough Drying Process

III. SOIL PROPERTY SYMBOLS:

MC - Natural Moisture Content in %.

DRY WT.- Unit Dry Weight in Pounds per Cubic Foot.

LL - Liquid Limit in %.

PL - Plastic Limit in %.

PI - Plasticity Index in %

Qp - Unconfined Compressive Strength in Tons per Square Foot Calibrated Penetrometer Value

Qu - Unconfined Compressive Strength in Tons per Square Foot Obtained in Laboratory at Controlled Rate of Strain

BLOWS - The "blows" are the recorded results of the Standard Penetration Test (SPT). In this field test, a standard Split Spoon Sampler (2" O.D.- 1 3/8" I.D.) is driven into the soil for a total penetration of 18 inches by a 140-pound hammer which is repeatedly dropped freely for a distance of 30 inches.

The number of blows are recorded (field logs) for each 6 inches of penetration, and the penetration resistance, "N", is considered as the number of blows required for the last 12 inches of penetration.

EXAMPLE: 3-8-6 "N" = 14 blows/foot

The SPT "N" value for split-spoon refusal conditions is typically estimated as greater than 100 blows per foot. When split-spoon refusal occurs, often little or no sample is recovered.

For our own in-house purposes, refusal is estimated at 50 blows per 6 inches. Where the sampler is observed not to penetrate after 50 blows, the "N" value is reported as 50/0". Otherwise, the depth of penetration after 50 blows is reported in inches (i.e. 50/5", 50/2"). Should the sampler not penetrate the full 18 inches, the results are recorded as follows:

EXAMPLE: 6-21-50/3"

This means that 6 blows were required for the first 6 inches of penetration, 21 blows were required for the second 6 inches of penetration, and 50 blows were required for the last 3 inches of penetration.

▽ - Groundwater Level During Drilling

▼ - Groundwater Level at Indicated Hours Following Boring Completion

IV. APPROXIMATE RELATIVE DENSITY AND CONSISTENCY OF SOILS ON THE BASIS OF THE STANDARD PENETRATION TEST:

NONCOHESIVE SOILS		COHESIVE SOILS*	
BLOWS/FT.** RELATIVE DENSITY		BLOWS/FT ** CONSISTENCY	
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium
30 - 50	Dense	8 - 15	Stiff
50+	Very Dense	15 - 30	Very Stiff
		30+	Hard

* Use with caution

**Penetration Resistance "N"

V. QUANTITATIVE EXPRESSIONS FOR THE CONSISTENCY OF CLAYS:

UNCONFINED COMPRESSIVE STRENGTH

CONSISTENCY T.S.F. FIELD IDENTIFICATION

Very Soft	0.0 - 0.25	Easily penetrated several inches by fist.
Soft	0.25 - 0.5	Easily penetrated several inches by thumb.
Medium	0.5 - 1.0	Penetrated by thumb with moderate effort.
Stiff	1.0 - 2.0	Readily indented by thumb but penetrated only with great effort.
Very Stiff	2.0 - 4.0	Readily indented by thumbnail.
Hard	4.0+	Indented with difficulty by thumbnail.

MAJOR DIVISIONS			GRAPH SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than 50% of Material is LARGER than No. 200 Sieve Size	GRAVEL AND GRAVELLY SOILS More than 50% of Coarse Fraction RETAINED on No. 4 Sieve	CLEAN GRAVELS (Little or No Fines)		GW	Well-Graded Gravel, Gravel-Sand Mixture, Little or No Fines
				GP	Poorly-Graded Gravel, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (Appreciable Amount of Fines)		GM	Silty Gravel, Gravel-Sand-Silt Mixtures
				GC	Clayey Gravel, Gravel-Sand-Clay Mixtures
	SAND AND SANDY SOILS More than 50% of Coarse Fraction PASSING on No. 4 Sieve	CLEAN SAND (Little or No Fines)		SW	Well-Graded Sand, Gravely Sands, Little or No Fines
				SP	Poorly-Graded Sand, Gravely Sands, Little or No Fines
		SANDS WITH FINES (Appreciable Amount of Fines)		SM	Silty Sand, Sand-Silt Mixtures
				SC	Clayey Sand, Sand-Clay Mixtures
FINE GRAINED SOILS More than 50% of Material is SMALLER than No. 200 Sieve Size	SILTS AND CLAYS Liquid Limit LESS than 50%			ML	Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand or Clayey Silt with Slight Plasticity
				CL	Inorganic Clay of Low to Medium Plasticity, Gravely Clay, Sandy Clay, Silty Clay, Lean Clay
				OL	Organic Silt and Organic Silty Clay of Low Plasticity
	SILTS AND CLAYS Liquid Limit GREATER than 50%			MH	Inorganic Silt, Micaceous or Diatomaceous Fine Sand or Silty Soil, Elastic Silt
				CH	Inorganic Clay of High Plasticity, Fat Clay
				OH	Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS				PT	Peat, Humus, Swamp Soils with High Organic Contents

SOIL CLASSIFICATION CHART

NOTES:

- 1) DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.
- 2) IN THE CASE OF COMBINATIONS, THE PREDOMINANT MATERIAL WILL BE IN HEAVY SYMBOL.

GEOTECHNICS

Soil & Material Testing

13118 North 9th Street, Oakridge, IL Ph (618) 223-8810 - Fax (618) 223-9805
 1111 4510 Peoria Street, Peoria, IL Ph (312) 681-0020 - Fax (312) 681-0012
 13110 N. Third Street, Suite 100, Burlington, IA Ph (515) 753-1898 - Fax (515) 753-9805
 Internet Address: www.kimmoner.com

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 -

Project No.: 20-5033

Project: ISTS New Fitness Center

Boring Log

Rig: CME 55 (B-55)

Location: See Location Image

Client: State of Missouri

Driller: AJK

Boring No.: 1

SUBSURFACE PROFILE						SAMPLE				Standard Penetration Test blows/ft.	Water Content % Wp ——— WI
Depth (ft.)	Symbol	Description	Qp, t.s.f.	Dry Density, P.C.F.	Depth/Elev.	Number	Type	Blows/ft.	Qu, T.S.F.		
0		Ground Surface			609.8					10 20 30 40	10 20 30 40
		Topsoil (±9")			609.1						
		Fill: Lean Clay (CL), Brown, Silty, Moist			0.8	0	HA				22.9
		Fill: (CL), Silty, Stiff, Moist	1.50	90.3	606.3	1	SS	9	1.65		24.3
		Lean Clay (CL), Yellow Brown, Silty, Stiff, Moist			3.5						26.2
5		(CL), Light Gray mottled Yellow Brown, Silty, Stiff, Moist	1.75			2	SS	8			29.8
		(CL), Silty, Medium, Moist	1.25	92.9		3	ST		0.78		30.7
10		Silt (ML), Light Gray mottled Yellow Brown, Very Loose/Very Soft, Moist	0.00		599.8	4	SS	2			31.9
		(ML), Loose/Medium, Moist	0.50	95.0	10.0	5	SS	4	0.81		29.6
15		(ML), Loose/Medium, Wet	1.00			6	SS	4			35.7
		(ML), Very Loose/Soft	0.25			7	SS	2			41.9
20		(ML), Trace Organics, Loose/Medium	0.50	76.5		8	SS	4	0.68		
		End of Boring @ 21½ Ft.			588.3						
					21.5						
25											
30											

Drill Method: 3 1/4" HSA and AW Rod

Boring Started: 10/28/2020

Boring Completed: 10/28/2020

Tested By: MAS/AJK

Logging By: MAS

GEOTECHNICS
Soil & Material Testing

Groundwater Elev. During Drilling: 594.8

Groundwater Elev. @ Comp.: 598.8

Groundwater Elev. @ 1.5 Hrs.: 598.8

Boring Location: See Location Image

Sheet 1 of 1

Project No.: 20-5033

Project: ISTS New Fitness Center

Client: State of Missouri

Boring No.: 2

Boring Log

Rig: CME 55 (B-55)

Location: See Location Image

Driller: AJK

SUBSURFACE PROFILE						SAMPLE				Standard Penetration Test blows/ft.	Water Content %	
Depth (ft.)	Symbol	Description	Qp, t.s.f.	Dry Density, P.C.F.	Depth/Elev.	Number	Type	Blows/ft.	Qu, T.S.F.		Wp	WI
0		Ground Surface			610.1							
		Topsoil (±6")			609.6							
		Lean Clay (CL), Brown, Silty, Moist			0.5	0	HA					29.4
		(CL), Mottled Gray, Silty, Medium, Moist	0.75	101.6		1	SS	3	0.64			24.9
5		(CL), Brown/Light Brown mottled Yellow Brown, Silty, Stiff, Moist	2.50			2	SS	10				26.3
		(CL), Light Brown mottled Yellow Brown, Silty, Stiff, Moist	1.25	92.4		3	SS	8	1.09			28.1
10		Silt (ML), Light Gray mottled Yellow Brown, Medium, Moist	1.25	91.7	600.1 10.0	4	ST		0.50			31.4
		(ML), Loose/Medium, Moist	0.25			5	SS	4				32.2
15		(ML), Loose/Stiff, Wet	0.50	100.9		6	SS	6	1.01			28.4
		End of Boring @ 16½ Ft.			593.6 16.5							

Drill Method: 3 1/4" HSA and AW Rod

Boring Started: 10/28/2020

Boring Completed: 10/28/2020

Tested By: MAS/AJK

Logging By: MAS

GEOTECHNICS
Soil & Material Testing

Groundwater Elev. During Drilling: 595.1

Groundwater Elev. @ Comp.: 598.1

Groundwater Elev. @ 0.5 Hrs.: 599.1

Boring Location: See Location Image

Sheet 1 of 1

Project No.: 20-5033

Project: ISTS New Fitness Center

Client: State of Missouri

Boring No.: 3

Boring Log

Rig: CME 55 (B-55)

Location: See Location Image

Driller: AJK

SUBSURFACE PROFILE						SAMPLE				Standard Penetration Test blows/ft.	Water Content % Wp ——— WI
Depth (ft.)	Symbol	Description	Qp, t.s.f.	Dry Density, P.C.F.	Depth/Elev.	Number	Type	Blows/ft.	Qu, T.S.F.		
0		Ground Surface			605.7					10 20 30 40	10 20 30 40
		Topsoil (±9")			605.0						
		Fill: Lean Clay (CL), Brown, Silty, Trace Organics, Stiff, Moist			0.8	1	SS	9			19.1
		Fill: (CL), Mottled Light Gray, Silty, Very Stiff, Moist	2.00	100.0		2	SS	12	2.62		22.7
5		Lean Clay (CL), Light Gray mottled Yellow Brown, Silty, Stiff, Moist	2.25	92.1	600.7	3	SS	10	1.24		27.7
					5.0						
		End of Boring @ 6½ Ft.			599.2						
					6.5						
10											
15											
20											
25											
30											

Drill Method: 3 1/4" HSA and AW Rod

Boring Started: 10/28/2020

Boring Completed: 10/28/2020

Tested By: MAS/AJK

Logging By: MAS

GEOTECHNICS
Soil & Material Testing

Groundwater Elev. During Drilling: ▽

Groundwater Elev. @ Comp.: ▽

Groundwater Elev. @ Hrs.: ▽

Boring Location: See Location Image

Sheet 1 of 1

Project No.: 20-5033

Project: ISTS New Fitness Center

Client: State of Missouri

Boring No.: 4

Boring Log

Rig: CME 55 (B-55)

Location: See Location Image

Driller: AJK

SUBSURFACE PROFILE						SAMPLE				Standard Penetration Test blows/ft.	Water Content % Wp ——— WI
Depth (ft.)	Symbol	Description	Qp, t.s.f.	Dry Density, P.C.F.	Depth/Elev.	Number	Type	Blows/ft.	Qu, T.S.F.		
0		Ground Surface			608.2						
		Topsoil (±9")			607.7						
		Lean Clay (CL), Brown, Silty, Medium, Moist	0.25	107.5	0.5	1	SS	1	0.80		27.0
		(CL), Silty, Medium, Moist	1.00	98.3		2	SS	5	0.97		24.1
5		(CL), Light Gray mottled Yellow Brown, Silty, Stiff, Moist	1.75	94.0		3	SS	9	1.47		27.3
		End of Boring @ 6½ Ft.			601.7 6.5						
10											
15											
20											
25											
30											

Drill Method: 3 1/4" HSA and AW Rod

Boring Started: 10/28/2020

Boring Completed: 10/28/2020

Tested By: MAS/AJK

Logging By: MAS

GEOTECHNICS
Soil & Material Testing

Groundwater Elev. During Drilling: ▽

Groundwater Elev. @ Comp.: ▽

Groundwater Elev. @ .5 Hrs.: ▽

Boring Location: See Location Image

Sheet 1 of 1