PROJECT MANUAL

10 New Premium Sites and 6 Premium Cabins & Site Repairs and Renovations

Wakonda State Park

Lagrange, Missouri

Designed By: Klingner & Associates
3622 Endeavor Ave Suite 117
Columbia, MO 65201

Date Issued: October 31, 2025

Project No.: X2410-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

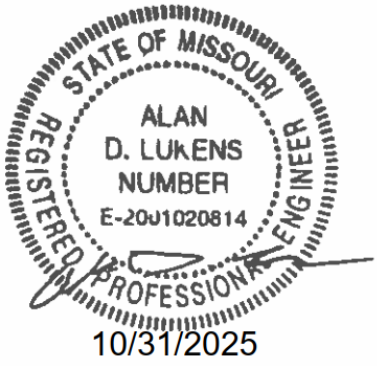
Facilities Management, Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: X2404-01

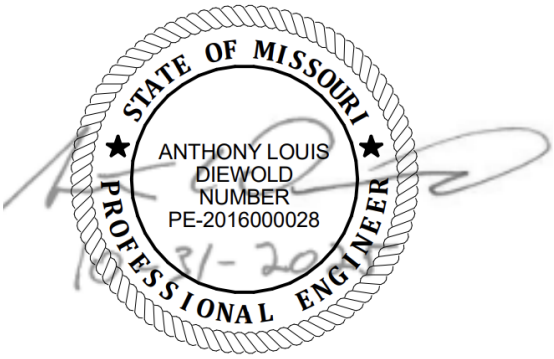
THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

Kurt Fanderclai, Architect
A-2023012887
Project Manual Division 06, 07, 08, 09, 10, and 12

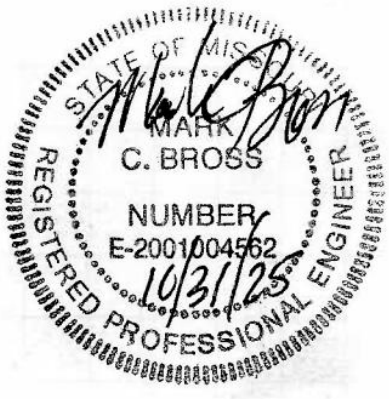


Alan Lukens, Engineer
E-2001020814
Project Manual Division 03 and sections 061000, 061753

Curt Wavering, Engineer
PE-2011009046
Project Manual Division 31, 32, 33, and 40



Anthony Diewold, Engineer
PE-2016000028
Project Manual Division 20, 22, 23, and 26



Mark Bross, Engineer
E-2001004562
Project Manual Division 40

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NOTICE TO BIDDERS

The following procurement forms can be found on our website at:
https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans
and shall be submitted with your bid to FMDCBids@oa.mo.gov

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004340	SDVE Business Form	*
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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:

	TITLE	SHEET #	DATE	CAD #
1	Cover Sheet	G001	10/31/2025	G001
2	Legend & General Notes	G002	10/31/2025	G002
3	Sheet Index	G003	10/31/2025	G003
4	Storm Water Pollution Prevention Plan	G004	10/31/2025	G004
5	Beach Comfort Station Existing Conditions Site Plan	C001	10/31/2025	C001
6	Campsites Existing Conditions & Demolition Site Plan	CD101	10/31/2025	CD101
7	Cabins Existing Conditions & Demolition Site Plan	CD102	10/31/2025	CD102
8	Beach Comfort Station Site Demolition Plan	CD103	10/31/2025	CD103
9	Campsites Overall Site Plan	C101	10/31/2025	C101
10	Campsites Road Plan & Profile	C102	10/31/2025	C102
11	Campsites Road Plan & Profile	C103	10/31/2025	C103
12	Campsites Road Plan & Profile	C104	10/31/2025	C104
13	Cabins Site Plan	C105	10/31/2025	C105
14	Beach Comfort Station Site Plan	C106	10/31/2025	C106
15	Campsites Site Grading Plan	C201	10/31/2025	C201
16	Cabins Site Grading Plan	C202	10/31/2025	C202
17	Beach Comfort Station Grading and Erosion Control	C203	10/31/2025	C203

18	Campsites Site Utility Plan	C301	10/31/2025	C301
19	Campsites Sanitary Sewer Profile & Site Details	C302	10/31/2025	C302
20	Cabins Site Utility Plan	C303	10/31/2025	C303
21	Cabins Sewer Plan & Profile Sta. 0+00 To Sta. 5+50	C304	10/31/2025	C304
22	Cabins Sewer Plan & Profile Sta. 5+50 To Sta. 11+18.08	C305	10/31/2025	C305
23	Beach Comfort Station Site Utility Plan	C306	10/31/2025	C306
24	Alternate – Sanitary Site Plan	C400	10/31/2025	C400
25	Alternate – Lagoon Forcemain – (0+00-5+00)	C401	10/31/2025	C401
26	Alternate – Lagoon Forcemain – (5+00-10+00)	C402	10/31/2025	C402
27	Alternate – Lagoon Forcemain – (10+00-15+00)	C403	10/31/2025	C403
28	Alternate – Lagoon Forcemain – (15+00-20+00)	C404	10/31/2025	C404
29	Alternate – Lagoon Forcemain – (20+00-25+00)	C405	10/31/2025	C405
30	Alternate – Lagoon Forcemain – (25+00-30+00)	C406	10/31/2025	C406
31	Alternate – Lagoon Forcemain – (30+00-35+00)	C407	10/31/2025	C407
32	Alternate – Lagoon Forcemain – (35+00-40+00)	C408	10/31/2025	C408
33	Alternate – Lagoon Forcemain – (40+00-44+00)	C409	10/31/2025	C409
34	Alternate – Beach House Forcemain – (0+00-3+75)	C410	10/31/2025	C410
35	Alternate – Combined LS To Tie-In (0+00-5+00)	C411	10/31/2025	C411
36	Alternate – Combined LS To Tie-In (5+00-9+06)	C412	10/31/2025	C412
37	Alternate – Ranger Gravity Sewer (0+00-2+07)	C413	10/31/2025	C413
38	Alternate – North Campsite Forcemain (0+00-5+00)	C414	10/31/2025	C414
39	Alternate – North Campsite Forcemain (5+00-10+00)	C415	10/31/2025	C415
40	Alternate – North Campsite Forcemain (10+00-15+00)	C416	10/31/2025	C416

41	Alternate – North Campsite Forcemain (0+00-5+00)	C417	10/31/2025	C417
42	Alternate – North Campsite Forcemain (15+00-18+65)	C418	10/31/2025	C418
43	Campsites & Cabins Site Details	C501	10/31/2025	C501
44	Campsites & Cabins Site Details	C502	10/31/2025	C502
45	Campsites & Cabins Site Details	C503	10/31/2025	C503
46	Campsites & Cabins Site Details	C504	10/31/2025	C504
47	Beach Comfort Station Site Details	C505	10/31/2025	C505
48	Beach Comfort Station Site Details	C506	10/31/2025	C506
49	Beach Comfort Station Site Details	C507	10/31/2025	C507
50	Beach Comfort Station Site Details	C508	10/31/2025	C508
51	Beach Comfort Station Site Details	C509	10/31/2025	C509
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54	Alternate – Forcemain Details	C605	10/31/2025	C605
55	Alternate – Miscellaneous Details	C606	10/31/2025	C606
56	Alternate – Lift Station Details	C607	10/31/2025	C607
57	Alternate – Wet Well Plans	C608	10/31/2025	C608
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62	Reflected Ceiling Plans – Cabin “A”	A112	10/31/2025	A112
63	Roof Plan – Cabin “A”	A113	10/31/2025	A113
64	First Floor Annotation Plan – Cabin “B”	A114	10/31/2025	A114
65	First Floor Dimension Plan – Cabin “B”	A115	10/31/2025	A115
66	Reflected Ceiling Plans – Cabin “B”	A116	10/31/2025	A116
67	Roof Plan – Cabin “B”	A117	10/31/2025	A117
68	Building Elevations – Cabin “A”	A201	10/31/2025	A201
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70	Building Sections – Cabin “A”	A301	10/31/2025	A301
71	Building Sections – Cabin “A”	A302	10/31/2025	A302
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75	Wall Sections – Cabin “A”	A311	10/31/2025	A311
76	Enlarged Plans and Elevations	A401	10/31/2025	A401
77	Enlarged Plans and Elevations	A402	10/31/2025	A402
78	Enlarged Plans and Elevations	A403	10/31/2025	A403
79	Details -Plan View	A501	10/31/2025	A501
80	Details – Wall Section	A510	10/31/2025	A510
81	Door & Window Schedule & Details	A601	10/31/2025	A601
82	First Floor Finish Plan & Schedules	A710	10/31/2025	A710
83	Structural Notes	S001	10/31/2025	S001
84	Foundation Plan – Cabin “A”	S101	10/31/2025	S101
85	Foundation Plan – Cabin “B”	S102	10/31/2025	S102
86	Roof and Ceiling Framing Plan – Cabin “A”	S210	10/31/2025	S210
87	Roof and Ceiling Framing Plan – Cabin “B”	S211	10/31/2025	S211
88	Ships Ladder Details	S401	10/31/2025	S401
89	Foundation Details	S501	10/31/2025	S501
90	Structural Details	S510	10/31/2025	S510
91	Structural Details	S511	10/31/2025	S511
92	Structural Details	S512	10/31/2025	S512
93	MEP General Notes & Symbols	MEP001	10/31/2025	MEP001
94	Plumbing Plan	P101	10/31/2025	P101
95	Plumbing Details and Schedules	P501	10/31/2025	P501
96	Mechanical Plan	M101	10/31/2025	M101
97	Mechanical Details & Schedules	M501	10/31/2025	M501
98	Airflow Schematics	M701	10/31/2025	M701
99	Electrical Plan – Cabin A	E101	10/31/2025	E101
100	Electrical Plan – Cabin B	E102	10/31/2025	E102
101	Electrical Schedules & Details	E501	10/31/2025	E501
102	Alternate – Electrical Details	E502	10/31/2025	E502
103	Alternate – Typical Lift Station Control Panel	E601	10/31/2025	E601
104	Alternate – Combined Lift Station Control Panel	E602	10/31/2025	E602
105	Alternate – Simplex Lift Station Control Panel	E603	10/31/2025	E603

END OF SECTION 000115

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. 10 New Premium Sites and 6 Premium Cabins & Site Repairs and Renovations
Wakonda State Park
Lagrange, Missouri
Project No.: X2410-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, March 17, 2026

B. **Only electronic bids sent to FMDCBids@oa.mo.gov shall be accepted: (See Instructions to Bidders for further detail)**

4.0 DESCRIPTION:

A. Scope: The Project consists of Beach Comfort Station Upgrades, Addition of six (6) premium cabins with utilities and site improvements, Addition of ten (10) premium back in campsites with utilities and access road, and the connection of Park sanitary facilities to the City of LaGrange Sewer System.

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.**

5.0 PRE-BID MEETING:

A. Place/Time**:** 10:00 AM, March 3, 2026, at Wakanda State Park Park office, 32836 State Pk Rd, La Grange, MO 63448

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 $100.00 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, Curt S. Wavering, (217) 430-2705, email: csw@klingner.com

B. Project Manager: Aaron Libbert, (816)7973442, email: aaron.libbert@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 Bidder with applicable federal laws and regulations. The Bidder should review Section 007333, Supplementary General Conditions for Federally Funded/Assisted Construction Projects and Section 007334, Terms and Conditions for Contractor Receipt of Federal ARPA SLFRF Funds, which are made part of this Invitation to Bid and will be made part of the resulting contract by reference.

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 one (1) party may be limited in accordance with available supply.

B. For the convenience of contractors, subcontractors and suppliers, bidding documents are available on the Owner's website at 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 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 successful Bidder (contractor) to fulfill every detail of the requirements of the contract, nor accepted as a basis for any claims for extra compensation or time extension.

B. Under no circumstances will Bidders give their plans and specifications to other Bidders. It is highly encouraged, but not required, that all Bidders be on the official planholders list to receive project updates including but not limited to any addenda that are issued during the bidding process.

4.0 - INTERPRETATIONS

A. No Bidder shall be entitled to rely on oral or written representations from any person as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction.

B. Bidders shall make all requests for interpretations in writing and submit all requests to the Project Designer and Project Manager identified in Section 007300 – Supplementary Conditions with all necessary supporting documentation no less than five (5) working days before opening of bids. Responses to requests for interpretation will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.

C. Bidders shall make all requests for an "Acceptable Substitution" on the Section 006325 Substitution Request Form. The request shall be emailed to the Project Designer and Project Manager identified in Section 007300 – Supplementary Conditions no less than five (5) working days before opening of bids. Responses to requests for substitutions will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.

D. An "Acceptable Substitution" requested after the award of bid will only be approved if proven to the satisfaction of the Owner and the Designer 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 and all requests of this nature must be submitted in accordance with Article 3.1 of the General Conditions.

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 on the bid documents or the bid will be rejected for being non-responsive.

B. Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals. Bidders must verify each specific project's requirements in Section 004113 to ensure they have provided all the required documentation with their submission.

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

C. The Bidder shall submit its bid on the forms provided by the Owner in the same file format (PDF) with each space fully and properly completed, typewritten or legibly printed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner will reject bids that are not on the Owner's forms or that do not contain all requested information. All forms can be found on the Owner's website at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans and shall be submitted with your bid to FMDCBids@oa.mo.gov.

D. All bids shall be submitted without additional terms and conditions, modifications, or reservations. The completed forms should not include interlineations, alterations, or erasures. Bids not in compliance with the requirements of this paragraph will be rejected as non-responsive.

E. 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 in the bid documents in Section 004113. Failure of the Bidder to submit the duly authorized bid bond or 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 bid closing or if the Bidder, within ten (10) working days after notification of award, refuses or is unable to 1) execute the tendered contract, 2) provide an acceptable performance and payment bond, or 3) provide evidence of required insurance coverage.

F. The bid bond 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.

6.0 - SIGNING OF BIDS

A. 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. If the Bidder is an entity organized in a state other than Missouri, the Bidder must provide a Certificate of Authority to do business in the State of Missouri.

B. If the successful Bidder is doing business in the State of Missouri under a fictitious name, the Bidder 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.

C. A bid from an individual shall be signed as noted on the Bid Form.

D. 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.

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

F. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual and the corporate license number shall be provided. In addition, for corporate proposals, the President or Vice-President listed per the current filing with the Missouri Secretary of State should sign as the Bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

7.0 - RECEIVING BID SUBMITTALS

A. It is the Bidder's sole responsibility to ensure receipt of the bid submittals by Owner on or before the date and time specified in the Invitation for Bid or as modified via written addenda. Bids received after the date and time specified will not be considered by the Owner.

B. All bids shall be received via email at FMDCBids@oa.mo.gov and bids received by the Owner through any other means, including hard copies, will not be considered, and will be discarded by the Owner unopened.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

A. Bidder may withdraw a bid at any time prior to the 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. Bidder may modify a bid until the scheduled closing time by sending a revised bid to FMDCBids@oa.mo.gov with a note in the subject line and body of the email that it is a revised bid. All revised bids must be submitted to FMDCBids@oa.mo.gov, revised bids sent any other way will not be considered.

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 limited to, contracts for the furnishing and installation of furniture, equipment, machinery, appliances and other apparatuses.

C. The Owner will award a contract to the lowest, responsive, and responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.

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 lowest, responsive, responsible bidder.

E. No award shall be considered binding upon the Owner until the written contract has been properly executed and the following documentation has been provided: 1) performance and payment bond consistent with Article 6.1 of the General Conditions; 2) proof of the required insurance coverage; 3) an executed Section 004541 - Affidavit of Work Authorization form; and 4) documentation evidence enrollment and participation in a federal work authorization program.

F. Failure to execute and return the contract and associated documents within the prescribed period 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.

G. 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.

H. 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. 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.e-verify.gov/employers/enrolling-in-e-verify. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

I. The successful Bidder must be registered in MissouriBUYS powered by MOVERS at https://missouribuys.mo.gov/supplier-registration# as an approved vendor prior to being issued a contract.

10.0 - CONTRACT SECURITY

A. The successful Bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 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, manufacturer, or suppliers 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. 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 or if more than one subcontractor is listed for any category without designating the portion of work to be performed by each, 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 Bidder'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. 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 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 required to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with its 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.

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 nonresponsive, and its bid shall be rejected.

2. The Bidder should submit with its bid all 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 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 Prime Bidder that qualifies as an SDVE shall receive a three-percentage 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 will become 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.

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.) 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 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 Equal Opportunity or by the Federal U.S. Small Business Administration directory.

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 Office of Equal Opportunity online SDVE directory at https://oeo.mo.gov/sdve-certification-program/ or the Federal U.S. Small Business Administration directory https://veterans.certify.sba.gov/#search.

3. Additional information, clarifications, or other information regarding the MBE/WBE/SDVE listings in the directories may be obtained by contacting 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 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 granted a waiver and will be considered 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;

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 in the 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 nonresponsive 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 the 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 in writing.

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
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.

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: **10 New Premium Sites and 6 Premium Cabins**
& Site Repairs and Renovations
Wakonda State Park
Lagrange, Missouri

Project Number: **X2410-01**

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 **250 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.

SAMPLE

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: $

Accepted Alternates, if applicable to the Project and accepted by the Owner.

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices:

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased 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: The requirements of the Davis-Bacon Act are not applicable to this project, which is funded solely by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).

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:

SAMPLE

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. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
    iii. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
    iv. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
    v. Missouri Service Disabled Veteran Business Form (Section 004340)
    vi. Affidavit of Work Authorization (Section 004541)
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), if applicable
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

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder's Certifications of the Bid Form.

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

APPROVED:

_____ _____

Brian Yansen, Director
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

SAMPLE

Bond No._____

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?

☐ YES ☐ NO

IF YES, EXPLAIN

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

☐ YES ☐ NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

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.

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

☐ 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

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

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

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	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	

Revised 06/2023

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

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

GENERAL CONDITIONS

INDEX

ARTICLE:

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1.3. Compliance with Laws, Permits, Regulations and Inspections

1.4. Nondiscrimination in Employment

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1.7. Preference for American and Missouri Products and Services

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1.9. Separate Contracts and Cooperation

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2. Owner/Designer Responsibilities

3. Contractor Responsibilities

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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

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. Acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
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"**: All supervision, labor, materials, tools, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents 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 ensure 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 under this clause to any labor union with which they have bargaining or other agreements.

B. 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 place 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 ensure 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 subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor’s fee: (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor’s mark-up for

Work performed by a sub-subcontractor and passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) 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 Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed two percent (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(s) 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 the same as those for additive Contract Changes provided above.

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 <u>without</u> 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.

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, home addresses of all workers, 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 contact 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:
Curt S. Wavering
Klingner & Associates
3622 Endeavor Ave Suite 117
Columbia, MO 65201
Telephone: (217) 430-2705
Email: csw@klingner.com

Construction Representative:
Kenneth Sheputis
Division of Facilities Management, Design and Construction
709 Missouri Blvd
Jefferson City, MO 65109
Telephone: (417) 576 - 7161
Email: Kenneth.sheputis@oa.mo.gov

Project Manager:
Aaron Libbert
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (816) 797-3442
Email: aaron.libbert@oa.mo.gov

Contract Specialist:
April Howser
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 751-0053
Email: april.howser@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 3 complete sets of drawings and specifications at no charge.

B. The Owner will furnish the Contractor with approximately 3 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 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 (American Rescue Plan Act (ARPA) 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 include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (4) in every subcontract or purchase order. 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.

8.0 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.

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

The requirements of the Davis-Bacon Act and this section are not applicable to this project, which is funded by Coronavirus State and Local Fiscal Recover Funds (SLFRF) under the American Rescue Plan Act (ARPA).

~~(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 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. pt.s 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.~~

10.0 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.

11.0 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.

12.0 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.

13.0 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.

14.0 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.

15.0 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.

16.0 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.

17.0 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.

18.0 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.

19.0 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. § 6201et seq.).

20.0 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.

21.0 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.

22.0 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.

23.0 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.

24.0 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.

25.0 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.

26.0 Required Use of American Iron, Steel, Manufactured Products, and Construction Materials – Build America, Buy America (Pub. L. No. 117-58, §§ 70901-52)

The Owner is the recipient of an award of Federal financial assistance from a program for infrastructure for this project. Pursuant to the Build America, Buy America Act of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58, none of the funds provided under the Federal award may be used unless the requirements of the domestic content procurement preference outlined below are met. Therefore, the Contractor shall ensure the following:

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 65 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

Waivers

When necessary, recipients of Federal financial assistance may apply for, and the awarding agency may grant, a waiver from the domestic content procurement preference.

When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:

> (1) applying the domestic content procurement preference would be inconsistent with the public interest;
>
> (2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
>
> (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described on the awarding agency web site.

If the Contractor determines that an application for a waiver is necessary or an existing waiver is applicable to this project, the Contractor shall timely notify the Owner. The Owner will make a determination if a waiver is applicable or if a waiver application is necessary. The Contractor shall not submit any waiver application or information directly to the Federal agency without prior approval by the Owner.

Definitions

"Construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of: • non-ferrous metals; • plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); • glass (including optic glass); • lumber; or • drywall.

"Domestic content procurement preference'' means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

"Infrastructure" includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

"Project" means the construction, alteration, maintenance, or repair of infrastructure in the United States.

27.0 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.

TERMS AND CONDITIONS FOR CONTRACTOR RECEIPT OF FEDERAL ARPA SLFRF FUNDS

I. Use of Funds: _____ ("Contractor") understands and agrees that the State of Missouri has received funds for this project under section 602(c) of the Social Security Act ("Act"), as added by Section 9901 of the American Rescue Plan Act ("ARPA"), Pub. L. No. 117-2 (March 11, 2021), 135 Stat. 4, 223–26, and the funds disbursed under such grant may only be used in compliance with the ARPA and the U.S. Department of the Treasury ("Treasury")'s regulations implementing that section and guidance, and in compliance with all other restrictions and specifications on use set forth in or applicable through this agreement.

Period of Performance: The period of performance for the award begins on the date hereof and ends no later than December 31, 2026. Contractor may use funds granted under this agreement to cover eligible costs incurred during the period of performance, but no later than December 31, 2026.

Reporting: Contractor agrees to comply with any reporting obligations established by Treasury or the State of Missouri ("State"), as it relates to this agreement.

Maintenance of and Access to Records: Contractor shall maintain records and financial documents sufficient to evidence compliance with section 602(c) of the Act and Treasury's regulations implementing that section and guidance regarding the eligible uses of funds. Contractor shall also maintain records and financial documents: 1. sufficient for the State, with respect to Contractor's participation in this grant agreement, to evidence compliance with section 602(c) of the Act and Treasury's regulations implementing that section and guidance regarding the eligible uses of funds; and 2. necessary for the State, with respect to Contractor's participation in this agreement, to comply with obligations under 2 C.F.R. Part 200 and any other applicable law. The Treasury Office of Inspector General, the Government Accountability Office, their authorized representatives, the State, or its authorized representatives, shall have the right of access to records and documents (electronic and otherwise) of Contractor in order to conduct audits or other investigations or reviews. Records shall be maintained by Contractor for a period of five (5) years after the end of the period of performance. Wherever practicable, records should be collected, transmitted, and stored in open and machine-readable formats. Contractor's obligations under this section shall include, without limitation, maintenance of the following specified types of records and financial documents: contracts, invoices, receipts, payrolls, and financial statements.

Pre-award Costs: Pre-award costs, as defined at 2 C.F.R. § 200.458, may not be paid with funding from this agreement.

Compliance with Applicable Law and Regulations: Contractor agrees to comply with the requirements of section 602 of the Act, regulations adopted by Treasury pursuant to section 602(f) of the Act, guidance issued by Treasury regarding the foregoing, and all other restrictions and specifications set forth in or applicable through this agreement. Contractor also agrees to comply with all other applicable state and federal statutes, regulations, and executive orders, and

Contractor shall provide for such compliance by other parties in any agreements it enters into with other parties relating to this grant.

Federal regulations applicable to this agreement include, without limitation, the following:

i. If the amount of this agreement is expected to equal or exceed $25,000, or if this agreement is for federally-required audit services, OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement), 2 C.F.R. Part 180, and Treasury's implementing regulation at 31 C.F.R. Part 19, including both the requirement to comply with that part's Subpart C as a condition of participation in this transaction, and the requirement to pass the requirement to comply with that subpart to each person with whom the participant enters into a covered transaction at the next lower tier;

ii. Recipient Integrity and Performance Matters, pursuant to which the award term set forth at 2 C.F.R. Part 200, Appendix XII, is hereby incorporated by reference;

iii. Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (42 U.S.C. §§ 4601–4655) and implementing regulations; and

iv. Generally applicable federal environmental laws and regulations.

Federal statutes and regulations prohibiting discrimination applicable to this agreement include, without limitation, the following:

i. Title VI of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d *et seq*.) and Treasury's implementing regulations at 31 C.F.R. Part 22, which prohibit discrimination on the basis of race, color, or national origin under programs or activities receiving federal financial assistance;

ii. the Fair Housing Act, Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§ 3601 *et seq*.) which prohibits discrimination in housing on the basis of race, color, religion, national origin, sex, familial status, or disability;

iii. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), which prohibits discrimination on the basis of disability under any program or activity receiving federal financial assistance;

iv. the Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq*.) and Treasury's implementing regulations at 31 C.F.R. Part 23, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance; and

v. For local governments only, Title II of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. §§ 12101 *et seq*.), which prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto.

Remedial Actions: The State reserves the right to impose additional conditions or requirements on Contractor's receipt of this funds under this agreement, as the State deems necessary or advisable, in order to facilitate compliance with any existing or additional conditions or requirements imposed upon the State by Treasury for the State's receipt of ARPA funds. The State also reserves the right to seek recoupment or repayment of funds under this agreement in whole or in part, in the event that Treasury seeks recoupment or repayment of payments made to the State, for reasons relating to Contractor's acts or omissions respecting this agreement. These reservations are expressed without limitation to any other rights the State may hold, either to impose additional conditions or requirements on Contractor's receipt of funds under this agreement or to recoup such funds in whole or in part, under this agreement or other applicable law.

Hatch Act: Contractor agrees to comply, as applicable, with requirements of the Hatch Act (5 U.S.C. §§ 1501–1508 and 7324–7328), which limit certain political activities of State or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.

False Statements: Contractor understands that making false statements or claims in connection with this award is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.

Publications: Any publications produced with funds from this agreement must display the following language: "This product [is being] [was] supported, in whole or in part, by federal award number [enter project FAIN] awarded to State of Missouri by the U.S. Department of the Treasury."

Debts Owed State and Federal Government: Any funds paid to Contractor (1) in excess of the amount to which Contractor is finally determined to be authorized to retain under the terms of this agreement; (2) that are determined by the Treasury Office of Inspector General to have been misused; or (3) that are determined by Treasury to be subject to a repayment obligation pursuant to sections 602(e) and 603(b)(2)(D) of the Act and have not been repaid by Contractor shall constitute a debt owed by the State to the federal government. In such instance, the funds constituting the State's debt to the federal government shall also constitute Contractor's debt to the State. Debts owed by Contractor to the State must be paid promptly by Contractor. A debt owed the State by Contractor under this agreement is delinquent if it has not been paid by the date specified in the State's initial demand for payment, unless other satisfactory arrangements have been made or if Contractor knowingly or improperly retains funds that are a debt as defined in this paragraph. The State will take any actions available to it to collect such a debt, including but not limited to actions available to it under the "Remedial Actions" paragraph found in this same section (I) above. The rights of the State as expressed in this paragraph are in addition to, and do not imply the exclusion of, any other rights the State may have under applicable law to collect a debt or seek damages from Contractor.

Disclaimer: In its award of federal financial assistance to the State, Treasury provides that the United States expressly disclaims any and all responsibility or liability to the State or third

persons for the actions of the State or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any other losses resulting in any way from the performance of this award or any contract or subcontract under this award. Furthermore, in its award of federal financial assistance to the State, Treasury also states that the acceptance of this award by the State does not in any way establish an agency relationship between the United States and the State. This disclaimer applies with equal force to this agreement.

Increasing Seat Belt Use in the United States: Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), Contractor is hereby encouraged to adopt and enforce on-the-job seat belt policies and programs for its employees when operating company-owned, rented or personally owned vehicles, and to encourage any subcontractors to do the same.

Reducing Text Messaging While Driving: Pursuant to federal Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), the State hereby encourages Contractor to adopt and enforce policies that ban text messaging while driving, and to encourage any subcontractors to do the same.[1]

II. By entering into this agreement, Contractor ensures its current and future compliance with Title VI of the Civil Rights Act of 1964, as amended, which prohibits exclusion from participation, denial of the benefits of, or subjection to discrimination under programs and activities receiving federal funds, of any person in the United States on the ground of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by Treasury Title VI regulations at 31 C.F.R. Part 22 and other pertinent executive orders such as federal Executive Order 13166; directives; circulars; policies; memoranda and/or guidance documents.

Contractor acknowledges that federal Executive Order 13166, "Improving Access to Services for Persons with Limited English Proficiency," seeks to improve access to federally assisted programs and activities for individuals who, because of national origin, have Limited English Proficiency ("LEP"). Contractor understands that denying a person access to its programs, services, and activities because of LEP is a form of national origin discrimination prohibited under Title VI of the Civil Rights Act of 1964 and Treasury's implementing regulations. Accordingly, Contractor shall initiate reasonable steps, or comply with Treasury's directives, to ensure that LEP persons have meaningful access to its programs, services, and activities. Contractor understands and agrees that meaningful access may entail providing language assistance services, including oral interpretation and written translation where necessary, to ensure effective communication in Contractor's programs, services, and activities.

Contractor agrees to consider the need for language services for LEP persons during development of applicable budgets and when conducting programs, services, and activities. As a resource, Treasury has published its LEP guidance at 70 FR 6067. For more information on LEP, please visit http://www.lep.gov.

[1] Section I is based on requirements set forth in Treasury's Coronavirus State Fiscal Recovery Fund Award Terms and Conditions document, executed by the State on July 26, 2021.

ontractor acknowledges and agrees that compliance with this assurance constitutes a condition of continued receipt of federal financial assistance and is binding upon Contractor and Contractor's successors, transferees, and assignees for the period in which such assistance is provided.

Contractor shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise discriminating against a person on the basis of race, color, or national origin (42 U.S.C. § 2000d et seq.*), as implemented by the Department of the Treasury's Title VI regulations, 31 C.F.R. Part 22, which are herein incorporated by reference and made a part of this agreement. Title VI also includes protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. § 2000d* et seq.*, as implemented by the Department of the Treasury's Title VI regulations 31 C.F.R. Part 22, and herein incorporated by reference and made a part of this agreement.*

Contractor shall cooperate in any enforcement or compliance review activities by Treasury or the State of the aforementioned obligations. Enforcement may include investigation, arbitration, mediation, litigation, and monitoring of any settlement agreements that may result from these actions. That is, Contractor shall comply with information requests, on-site compliance review, and reporting requirements.

Contractor shall maintain and provide to applicants, beneficiaries, their representatives, or any other party requesting the same, information on how to file a Title VI complaint of discrimination with the State of Missouri.

Contractor shall provide to the State documentation of an administrative agency's or court's findings of non-compliance of Title VI and efforts to address the non-compliance, including any voluntary compliance or other agreements between Contractor and the administrative agency that makes any such finding. If Contractor settles a case or matter alleging such discrimination, Contractor must provide to the State documentation of the settlement. If Contractor has not been the subject of any court or administrative agency finding of discrimination, Contractor shall so state.

The United States of America has the right to seek judicial enforcement of the terms of this assurances section and nothing in this section alters or limits the federal enforcement measures that the United States may take in order to address violations of this section or applicable federal law.

Under penalty of perjury, the undersigned certifies that he/she has read and understood this section's obligations as herein described, that any information submitted in conjunction with this assurance document is accurate and complete, and that Contractor is in compliance with the aforementioned nondiscrimination requirements.

By signing this certification, the undersigned represents his or her intention, and legal authorization, to do so on behalf of Contractor.[2]

_____
Company Name

_____ Date: _____
Signature of Contractor's Authorized Representative

_____
Printed Name of Contractor's Authorized Representative

Contractor's Unique Entity Identifier: _____
(*Name associated with the Unique Entity Identifier must match the Contractor's name on contract documents)

III. This agreement shall be conducted in accordance with the standards set forth at 2 C.F.R. §§ 200.317 through 200.327, as applicable. Pursuant to 2 C.F.R. § 200.327 and Appendix II to Part 200 of Title 2 of the C.F.R.:

i. Contracts for more than $250,000 must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

ii. All contracts in excess of $10,000 must address termination for cause and for convenience by the State, including the manner by which it will be effected and the basis for settlement.

iii. When required by federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 C.F.R. Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract must be conditioned upon the acceptance of the wage determination. The non-federal entity must report all suspected or reported violations to the federal awarding agency. The contracts must also include a provision for compliance with the

[2] Section II is based on requirements set forth in Treasury's Assurance of Compliance with Civil Rights Requirements document, executed by the State on July 26, 2021.

Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 C.F.R. Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-federal entity must report all suspected or reported violations to the federal awarding agency.

v. Where applicable, all contracts awarded by the non-federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Contract Work Hours and Safety Standards Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.[3]

vi. If the State or Contractor wishes to enter into a contract or subcontract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under the State's award of ARPA funds or this agreement, the State and/or Contractor must comply with the requirements of 37 C.F.R. Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

vii. Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA). [

viii. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide 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. Part 1986 Comp., p. 189) and 12689 (3 C.F.R. Part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by

[3] Additionally, "in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in [29 C.F.R.] § 5.1," 29 C.F.R. § 5.5(c) requires that another clause be included "in any such contract," *id*. For language appropriate to construction of this additional clause, see 29 C.F.R. § 5.5(c).

agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. This requirement applies when the amount of the agreement is expected to equal or exceed $25,000, or if the agreement is for federally-required audit services. 2 C.F.R. § 180.220.]

ix. Contractors that apply or bid for an award exceeding $100,000 must file the certification required by 31 U.S.C. § 1352, the Byrd Anti-Lobbying Amendment. Under that law, 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. Each tier must 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 non-federal award.

x. A non-federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. 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. In the performance of this agreement, Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired: 1. competitively within a timeframe providing for compliance with this agreement's performance schedule; 2. meeting this agreement's performance requirements; or 3. at a reasonable price. Information about this requirement, along with the list of EPA-designated items, is available at EPA's Comprehensive Procurement Guidelines webpage: http://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program. Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

xi. Pursuant to Pub. L. No. 115-232, H.R. 5515 (115th Congress, 2018), and 2 C.F.R. § 200.216, funds provided by this agreement shall not be obligated or expended 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. For purposes of this prohibition, "covered telecommunications equipment or services" has the meaning as set forth at Sec. 889(f)(3) of Pub. L. No. 115-232. *See also* 2 C.F.R. § 200.216.

xii. Pursuant to 2 C.F.R. § 200.322, as appropriate and to the extent consistent with law, Contractor should, to the greatest extent practicable under this agreement, 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). For purposes of this provision: 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.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MIKE KEHOE, Governor

Annual Wage Order No. 32

Section 056
LEWIS COUNTY

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

Original Signed by
Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2025**

Last Date Objections May Be Filed: **April 9, 2025**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$24.88*
Boilermaker	$24.88*
Bricklayer-Stone Mason	$24.88*
Carpenter	$24.88*
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$24.88*
Plasterer	
Communication Technician	$24.88*
Electrician (Inside Wireman)	$60.49
Electrician Outside Lineman	$24.88*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$24.88*
Glazier	$24.88*
Ironworker	$24.88*
Laborer	$24.88*
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$24.88*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$24.88*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$24.88*
Plumber	$24.88*
Pipe Fitter	
Roofer	$24.88*
Sheet Metal Worker	$24.88*
Sprinkler Fitter	$24.88*
Truck Driver	$24.88*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
LEWIS County

Section 056

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$24.88*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$24.88*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$24.88*
General Laborer	
Skilled Laborer	
Operating Engineer	$24.88*
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$24.88*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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

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

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

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

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

OVERTIME
and
HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

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

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

SECTION 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 Beach Comfort Station Upgrades, Addition of six (6) premium cabins with utilities and site improvements, Addition of ten (10) premium back in campsites with utilities and access road, and the connection of Park sanitary facilities to the City of LaGrange Sewer System.

1. Project Location: Wakonda State Park, 32836 State Park Road, LaGrange, Missouri 63448.

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 October 31, 2025 were prepared for the Project by Klingner & Associates, P.C, 907 East Ash, Columbia, Missouri.

C. The Work consists of multiple areas of work within the Wakonda State Park facility.

a. At the beach area, work will include the demolition of the existing Concession and restroom building, demolition of the existing septic tank, fencing, concrete sidewalks, concrete pavements, concrete stairs, utilities, rinse stations, and precast comfort station facilities.

b. The addition of the premium cabins will include the foundations and construction for six (6) new cabins, storm and sanitary sewers to serve the new cabins, water services, electrical services, site grading, concrete sidewalks and asphalt paving with an alternate for concrete paving.

c. The addition of the premium campsites will include the concrete campsite pads for ten (10) new sites, storm and sanitary sewers to serve the new campsites, water services, electrical services, site grading, and asphalt access road paving with an alternate for concrete paving.

d. The final area of work will be defined as an “Alternate Bid” and will include the connection of State Park sanitary facilities to the City of LaGrange sewer System. Alternate work area locations include the north campsite shower house, park manager’s house and shop, Beach comfort area, premium cabins and camp sites and south lagoon. Alternate work items will include lift stations, controls, electrical services, force mains, gravity sewer, site grading, and closure and decommissioning of the existing sanitary lagoon.

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. Owner Occupancy: Allow for Owner occupancy and use by the public.

2. 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.

B. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.5 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: The Owner will occupy the site and existing building 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.

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 twenty (20) "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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: *The work to be performed under Alternate #1 to furnish all labor, tools, materials, machinery and equipment necessary to complete the Work in accordance with the Contract Documents for the following: Sanitary sewer lift stations, controls, force mains, connection to the public utility, lagoon decommissioning and associated removals as identified*

on the plans. See Drawings, noted as Alternates and Project Manual for additional information.

B. Alternate No. 2: *The work to be performed under Alternate #2 to furnish all labor, tools, materials, machinery and equipment necessary to complete the Work in accordance with the Contract Documents for the following: The furnishing and installation of concrete parking lots at the Cabins site and concrete roadway pavements at the Campsites area in lieu of asphalt pavements in the base bid.*

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 Contactor 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 location[1] 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 system[2] 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.

SECTION 013200 – SCHEDULE – 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
013200	Schedules	Schedule of Submittals
013200	Schedules	Schedules of Tests & Inspections
013513	Site Security and Health Requirements	Product Data
013513	Site Security and Health Requirements	Certification
061613	Composite Wall and Roof Sheathing	Product Data
061613	Composite Wall and Roof Sheathing	Warranty
062023	Interior Finish Carpentry	Product Data
062023	Interior Finish Carpentry	Samples
074113	Metal Roof Panels	Product Data
074113	Metal Roof Panels	Sample
074113	Metal Roof Panels	Warranty
074213	Metal Wall Panels	Product Data
074213	Metal Wall Panels	Sample
074213	Metal Wall Panels	Warranty

077200	Roof Accessories	Product Data
079200	Joint Sealants	Product Data
079200	Joint Sealants	Samples
081433	Stile and Rail Wood Doors and Frames	Product Data
081433	Stile and Rail Wood Doors and Frames	Shop Drawings
081433	Stile and Rail Wood Doors and Frames	Warranty
082200	Fiberglass Doors and Frames	Product Data
082200	Fiberglass Doors and Frames	Shop Drawings
082200	Fiberglass Doors and Window	Warranty
085200	Aluminum Clad Wood Windows	Product Data
085200	Aluminum Clad Wood Windows	Shop Drawings
085200	Aluminum Clad Wood Windows	Warranty
089000	Louvers and Vents	Product Data
092900	Gypsum Board	Product Data
092000	Gypsum Board	Samples
096500	Resilient Flooring	Product Data
096500	Resilient Flooring	Sample
096500	Resilient Flooring	Warranty
099100	Painting	Product Data
099100	Painting	Samples
102818	Toilet and Bath Accessories	Product Data
104416	Fire Extinguishers	Product Data
107000	Precast Concrete Restroom	Shop Drawings
123530	Residential Casework	Product Data
123530	Residential Casework	Product Sample
123530	Residential Casework	Warranty
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
221119	Domestic Water Piping Specialties	Product Data
221119	Domestic Water Piping Specialties	Operation / Maintenance Manual
221316	Sanitary Waste and Vent Piping	Test Reports
221319	Sanitary Waste and Vent Piping Specialties	Product Data
223500	Domestic Water Heat Exchangers	Product Data
223500	Domestic Water Heat Exchangers	Operation / Maintenance Manual
223500	Domestic Water Heat Exchangers	Warranty
224000	Plumbing Fixtures	Product Data
224000	Plumbing Fixtures	Operation / Maintenance Manual
230700	HVAC Insulation	Product Data
233113	Metal Ducts	Shop Drawings
233300	Air Duct Accessories	Product Data
233713	Diffusers, Registers, And Grilles	Product Data
235400	Air Handling Units	Product Data
235400	Air Handling Units	Operation / Maintenance Manual
235400	Air Handling Units	Warranty
237200	Air-to-Air Energy Recovery Equipment	Product Data
237200	Air-to-Air Energy Recovery Equipment	Operation / Maintenance Manual
237200	Air-to-Air Energy Recovery Equipment	Warranty
238126	Air-to-Air Heat Pumps	Product Data
238126	Air-to-Air Heat Pumps	Operation / Maintenance Manual
238126	Air-to-Air Heat Pumps	Warranty

260519	Low Voltage Electrical Power Conductors and Cables	Product Data
260526	Grounding and Bonding for Electrical Systems	Product Data
260526	Grounding and Bonding for Electrical Systems	Field Quality Report
260533	Raceway and Boxes for Electrical Systems	Product Data
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
265600	Exterior Lighting	Product Data
312300	Excavation & Fill	Product Data
321300	Excavation & Fill	Samples
312513	Erosion Control	Product Data
312513	Erosion Control	Certification
321123	Aggregate Base Courses	Product Data
321313	Concrete Site Work	Product Data
321313	Concrete Site Work	Shop Drawings
321216	Asphalt Paving Mix Design	Product Data
323113	Chain Link Fences and Gates	Product Data
323113	Chain Link Fences and Gates	Shop Drawings
329219	Seeding	Certifications
329219	Seeding	Product Data / Schedule
329219	Seeding	Warranty
329219	Seeding	Maintenance Manual
330513	Manholes and Structures	Product Data
331100	Site Water Distribution Water Main Pipe Material	Product Data

331100	Site Water Distribution Water Main Pipe Material	Test Reports
333217	Submersible Wastewater Pumping Systems Material, Structures, Controls and Installation Manuals	Product Data
333217	Submersible Wastewater Pumping Systems Material, Structures, Controls and Installation Manuals	Shop Drawings
333217	Submersible Wastewater Pumping Systems Material, Structures, Controls and Installation Manuals	Operation & Maintenance Manual
333217	Submersible Wastewater Pumping Systems Material, Structures, Controls and Installation Manuals	Test Reports
333217	Submersible Wastewater Pumping Systems Material, Structures, Controls and Installation Manuals	Warranty
334100	Storm Utility Drainage Piping Storm Sewer Pipe Material and Structures	Product Data
334101	Sanitary Sewerage System Sanitary Sewer Pipe Material and Structures	Product Data
407113	Magnetic Flow Meter	Product Data
407113	Magnetic Flow Meter	Certification
407113	Magnetic Flow Meter	Operation & Maintenance Manual
407113	Magnetic Flow Meter	Warranty
C302	Campsite Power Pedestal	Product Data
C306	Rinse Station Shower	Product Data
C502	Campsite Water Pedestal	Product Data

END OF SECTION 013300

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 contractor ID badges found on FMDC's website at: 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 014529 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes

1. Owner shall employ and pay for an independent testing laboratory to perform testing as specified.

    a. Testing laboratory and procedures shall be as approved by the Engineer/Architect.

2. Contractor shall fully cooperate with the Owner and/or Engineer/Architect for additional testing required as determined by the Engineer/Architect.

1.2 QUALITY ASSURANCE

A. Testing shall be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials (ASTM).

1.3 PAYMENT FOR TESTING

A. Owner shall pay for all testing specified in the contract documents.

B. Payment for additional testing, not specified in original contract documents, but required as determined by the Engineer/Architect, shall be as follows:

1. The Owner will pay for initial testing.
2. When initial tests indicate noncompliance with the contract documents, the costs of initial tests associated with that noncompliance will be deducted from the contract sum.
3. Retesting: When initial tests indicate noncompliance with the contract documents, subsequent retesting occasioned by the noncompliance shall be performed by the same testing agency and costs thereof will be deducted from the contract sum.

END OF SECTION 014529

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, to 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".

1.4 PROJECT CONDITIONS

A. 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. 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.

G. 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.

H. 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. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.

B. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.

C. 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.

D. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.

E. 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.

F. 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.

G. Drinking-Water Facilities: Provide drinking-water, including paper cup supply.

H. 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. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

D. 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.

E. 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.

F. 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.

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 impending 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

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

1.3 SYSTEM DESCRIPTION

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

1.4 REFERENCE STANDARDS

A. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. AF&PA - American Forest & Paper Association; -.

D. PS 1 - Structural Plywood; 2023.

E. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2018.

1.5 DESIGN REQUIREMENTS

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

1.6 SUBMITTALS

A. Product Data: Provide data on void form materials and installation requirements include compressive strength.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with ACI SPEC-301, ACI CODE-318 and ACI 347R.

B. For wood products furnished for work of this Section, comply with AF&PA

C. Design of formwork:

1. Design, construction, and safety are the Contractor’s responsibility.

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 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

2.2 WOOD FORM MATERIALS

A. Plywood: Douglas Fir or Spruce species; solid one side grade; sound undamaged sheets with clean, true edges.

B. 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 (GR) Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

C. 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.

2.3 REMOVABLE PREFABRICATED FORMS

A. Furnish materials in accordance with State and local standards.

B. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

D. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4 inches thick.

E. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, free of defects that could leave 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 ½” 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 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: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.

2. Composition: Colorless, reactive, water-based compound.

3. Composition: Colorless, reactive, solvent-based compound.

a. VOC Content: In compliance with applicable local, State, and federal regulations.

E. Filler Strips for Chamfered Corners: Rigid plastic type; 3/4 x 3/4 inch size; maximum possible lengths.

F. Bituminous Joint Filler: ASTM D1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

H. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, make corrections or request instructions from Architect.

3.2 EARTH FORMS

A. Trench earth forms neatly, accurately to the footing widths indicated on Drawings.

B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

C. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.

D. Form sides of footings where earth sloughs.

E. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Obtain Architect approval before framing openings in structural members that are not indicated on drawings.

D. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

E. 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.

F. Forms for Smooth Finish Concrete:

1. Use steel, 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.

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

H. 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.

I. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

J. Install chamfer strips on external corners of beams, joists, columns and walls.

K. Install void forms in accordance with manufacturer's recommendations.

L. Do not patch formwork.

3.4 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 will 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.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will 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 in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. 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.

F. 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.

G. 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.

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

I. 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.

J. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, 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 CODE-318 for size and location limitations.

K. 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.

L. 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.

M. 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.

N. 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.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. 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.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

3.8 FIELD QUALITY CONTROL

A. The Owner will engage a qualified testing and inspecting agency to perform field special structural inspections and testing in accordance with the applicable International Building Code and submit reports.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect after placement of reinforcing steel in forms, but prior to placing concrete.

D. 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.

E. Schedule concrete placement to permit formwork inspection before placing concrete.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or corrective work.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

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 to prevent damage to form materials or to fresh concrete. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347R.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033000 - Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

B. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022a.

C. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

D. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.

E. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).

F. CRSI (DA4) - Manual of Standard Practice; 2023.

1.4 SUBMITTALS

A. See Section 013300 - Submittals, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, location of splices, and supporting and spacing devices. Provide sufficient details to permit installation of reinforcing.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

C. Perform Work in accordance with State and local standards.

1.6 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.

1.7 COORDINATION

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

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Plain billet-steel bars.

2. Epoxy coated in accordance with ASTM A775/A775M.

B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars, Grade 60 (60,000 psi)

1. Unfinished.

C. Smooth Dowel Bars: ASTM A615/A615M, grade 60 with metal end cap to allow longitudinal movement equal to joint width plus 1 inch.

D. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch .

a. Epoxy coated where epoxy coated reinforcing is indicated on the plans.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement conditions as needed including load bearing pad on bottom to prevent vapor barrier puncture.

3. 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.

    a. Plastic-coated tips in contact with forms.

    b. Plastic coating meeting requirements of CRSI Manual of Standard Practice

4. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

5. Provide stainless steel or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks per ACI CODE-318 and as indicated on Drawings.

D. Form reinforcement bends with minimum diameters in accordance with ACI CODE-318 .

E. Form ties and stirrups as indicated on the drawings in accordance with ACI CODE-318 .

F. Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI (DA4).

G. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

H. Locate reinforcing splices not indicated on drawings at point of minimum stress.

    1. Review locations of splices with Engineer.

2.3 SHOP FINISHING

A. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M.

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 barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows, unless otherwise indicated on the drawings::

1. Walls (exposed to weather or backfill): 2 inch.

2. Footings and Concrete Formed Against Earth: 3 inch.

3. Concrete exposed to earth or weather

a. No. 6 bars and larger 2 inch

b. No. 5 bars and smaller 1-1/2 inch

E. 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 CODE-318.

2. Splice reinforcing where indicated on Drawings in accordance with splicing device manufacturer's instructions and product's code report.

3. 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.

F. 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/D1.4M.

3.2 ERECTION TOLERANCES

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

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 CODE-318 material requirements and specified placement tolerances.

2. Welding: Inspect welds in accordance with AWS D1.4/D1.4M.

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/A706M.

5. Continuous Weld Inspection: Inspect reinforcement as required by ACI CODE-318 and International Building Code.

6. Periodic Weld Inspection: Inspect reinforcement as required by ACI CODE-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 SECTION INCLUDES

A. Foundations

B. Control, expansion and contraction joint devices.

C. Floors and slabs on grade.

D. Concrete foundation walls.

E. Joint devices associated with concrete work.

F. Concrete curing.

G. Other items as indicated on drawings

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 032000 - Concrete Reinforcing.

C. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI 305.1 - Specification for Hot Weather Concreting; 2014.

D. ACI 306.1 - Standard Specification for Cold Weather Concreting; 2015.

E. ACI 308.1 - Specification for Curing Concrete; 2011.

F. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

G. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

H. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2024.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

K. ASTM C42/42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete; 2020.

L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

M. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

N. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete; 2023.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

Q. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.

R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.

S. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 2022.

T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

U. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

W. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.

X. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

Y. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

Z. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement; 2018.

AA. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

BB. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2022.

CC. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete; 17.

DD. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

EE. ASTM C1157 - Standard Performance Specification for Hydraulic Cement; 2010.

FF. ASTM C1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration; 2019.

GG. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.

HH. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

II. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

JJ. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018 (Reapproved 2023).

KK. ASTM D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter; 2016a.

LL. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements; 2021.

MM. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

NN. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

OO. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

PP. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.

QQ. 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; 2018a.

RR. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.4 SUBMITTALS

A. See Section 013300- Submittals for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions.

3. Submit data on vapor barrier materials include tape and accessories.

C. Material Certificates: Submit material certificates signed by the manufacturer for the following:

1. Admixtures

2. Cementitious Materials

3. Coarse Aggregate

4. Fine Aggregate

5. Concrete Reinforcing Fibers

D. Design Data:

1. Mix Design: Submit proposed concrete mix design.

a. Indicate proposed mix design complies with requirements of ACI SPEC-301.

b. Indicate proposed mix design complies with requirements of ACI CODE-318.

c. Indicate proposed mix design complies with admixture manufacturer's written recommendations.

2. 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 SPEC-301.

b. Hot and cold weather concrete work.

c. Air entrained concrete work.

3. Identify mix ingredients and proportions, including admixtures.

4. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

E. Samples: Submit samples of underslab vapor retarder to be used.

F. Test Reports: Submit report for each test or series of tests specified.

G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-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. Fire Rated Construction: Rating as indicated on Drawings.

1. Tested Rating: Determined in accordance with ASTM E119.

F. Perform Work in accordance with State and local standards.

G. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.6 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.

1.7 COORDINATION

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

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.

1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.

C. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.

1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

D. Moisture Emission-Reducing Curing and Sealing Compound, Penetrating: Provide non-prorated warranty to cover cost of flooring delamination failures for 20 years.

1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 031000.

2.2 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 032000.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type II - Moderate Sulfate Resistance Portland type, gray.

1. Acquire cement for entire project from same source.

B. Blended Cement: ASTM C595/C595M; Type IP (25% Class F), Type IL, or Type IL(LH), gray.

1. Acquire cement for entire project from same source.

C. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Class F (Class C at interior locations only).

2. Slag Cement: ASTM C989/C989M, Grades 100 or 120.

D. Normal Weight Aggregates: Fine and Coarse Aggregates: ASTM C33/C33M.

1. Coarse Aggregate Maximum Size: See concrete mix design, in accordance with ACI CODE-318.

2. Aggregate sources shall not have a history of alkali silica reactivity.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete. potable, without deleterious amounts of chloride ions according to ACI CODE-318.

2.4 ADMIXTURES

A. All admixtures shall be sourced from a single manufacturer and be approved for use in the concrete mix design.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.06 percent by weight of cement.

C. Air Entrainment Admixture: ASTM C260/C260M.

D. Water Reducing Admixture: ASTM C494/C494M Type A.

E. Retarding Admixture: ASTM C494/C494M Type B.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

H. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

I. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

J. Specific performance admixtures: ASTM C494/C494M Type S.

1. Shall not affect strength development.

K. Workability-Retaining: ASTM C494/C494M Type S.

1. Shall retain concrete workability without affecting time of setting or strength development.

L. Porosity Inhibiting Admixture (PIA): ASTM C494/C494M Type S: Liquid, inorganic admixture free of volatile organic compounds (VOCs) and reactive silicates. Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces alkali silicate reaction (ASR) and concrete shrinkage with no adverse effect on concrete properties or applied flooring or roofing.

1. Provide admixture in slabs to receive adhesively applied flooring or roofing.

2. Hydraulic Conductivity: 6 x 10 exp(-8) fps, minimum, when tested according to ASTM D5084.

M. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring or roofing.

1. Provide admixture in slabs to receive adhesively applied flooring or roofing.

2.5 ACCESSORY MATERIALS

A. Vapor Barrier:

1. See Section 072100 Thermal Insulation

2. ASTM E1745, Class A; 15 vapor barrier; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

a. Maximum: Plus 4 percent.

b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2400 pounds per square inch.

4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

5. Products containing aluminum powder are not permitted.

2.6 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.

B. Bonding Agent:

1. Products:

a. Master Builders Solutions US LLC – Master Emaco ACH Series.

b. Euclid Chemical Company; Duralbond: www.euclidchemical.com/#sle.

c. Substitutions: Permitted upon approval of Engineer.

C. 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.

D. Joint Filler Type B: ASTM D1752; recycled PVC.

E. Joint Filler Type C: ASTM D1752; Premolded sponge rubber.

F. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2. Material: ASTM D1752, sponge rubber (Type I).

G. Sealant and Primer: as specified in Section 079200.

H. Sealant: ASTM D6690, Type III.

2.7 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

1. Product dissipates within 4 to 6 weeks.

C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.

1. Comply with ASTM C309 standards for water retention.

2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 14-day water cure when tested in accordance with ASTM C39/C39M.

3. VOC Content: Zero.

D. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.

1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.

2. Comply with ASTM C309 and ASTM C1315 Type I Class A.

3. VOC Content: Less than 100 g/L.

E. Curing and Sealing Compound, Moisture Emission-Reducing, Penetrating: Clear, water-based, non-film-forming curing agent; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission, moisture vapor emission, and alkalinity.

1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.

2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.

3. Chloride Ion Resistance of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C1202.

4. Comply with ASTM C309 and ASTM C1315 Type I Class A.

2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

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

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 CODE-318.

E. Normal Weight Concrete: Provide concrete to the following criteria:

1. Exterior concrete exposed to deicing chemicals (Structural Stoop Slabs):

Material and Property	Measurement
Compressive Strength (7 day)	3750 psi
Compressive Strength (28 day)	5000 psi
Cement Type	ASTM C150/C150M and ASTM C595/C595M
Cement Content (minimum)	658 pounds/cu yd
Aggregate Type	Normal weight
Fiber Reinforcement	0 percent by volume
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
Silica Fume Content	20 percent of cementitious materials by weight, maximum
Slag	15 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)	3300 psi
Compressive Strength (28 day)	4500 psi
Cement Type	ASTM C150/C150M and ASTM C595/C595M
Cement Content (minimum)	658 pounds/cu yd
Aggregate Type	Normal weight
Fiber Reinforcement	0 percent by volume
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
Silica Fume Content	20 percent of cementitious materials by weight, maximum
Slag	15 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/C150M and ASTM C595/C595M
Cement Content (minimum)	564 pounds/cu yd
Aggregate Type	Normal weight
Fiber Reinforcement	0 percent by volume
Water-Cement Ratio (maximum)	0.45 by weight
Aggregate Size (maximum)	1 inch
Aggregate Size (minimum)	1/2 inch
Air Content	0 percent to 3 percent
Fly Ash Content	20 percent of cementitious materials by weight, maximum
Silica Fume Content	20 percent of cementitious materials by weight, maximum
Slag	15 percent of cementitious materials by weight, maximum
Slump	4 inches maximum prior to water reducer, 8 inches maximum after water reducer

F. Average Compressive Strength Reduction: Permitted in accordance with ACI CODE-318.

2.9 MIXING

A. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

B. Site Mixed Concrete: Not permitted

C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

D. Do not use expansive component in same concrete batch with MVRA or PIA.

E. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

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.

C. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in according to bonding agent (where indicated on drawings) manufacturer's instructions. Remove laitance, coatings, and unsound materials.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

2. Use latex bonding agent only for non-load-bearing applications.

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.

E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

F. 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 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 inch 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.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI SPEC-301.

B. Notify testing laboratory and Architect minimum 48 hours prior to commencement of operations.

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

D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

G. Deposit concrete at final position. Prevent segregation of mix.

H. Place concrete in continuous operation for each panel or section determined by predetermined joints.

I. Consolidate concrete.

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

K. Place concrete continuously between predetermined expansion, control, and construction joints.

L. Do not interrupt successive placement; do not permit cold joints to occur.

M. Place floor slabs in saw cut pattern indicated.

3.4 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

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 construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

J. Install joint covers in longest practical length, when adjacent construction activity is complete.

K. Apply sealants in joint devices in accordance with Section 079200.

3.5 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:

1. Exposed Concrete Floors: 1/8 inch in 10 feet. Occur at wood floors and gymnasium floors.

2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.

3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. The minimum overall surface flatness shall be F_F35, levelness shall be F_L25, and local area minimums shall be F_F25, F_L20.

D. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

E. Correct the slab surface if composite overall value is less than specified.

F. Correct defects by grinding or by removal and replacement of the defective work. Re-measure corrected areas by the same process.

G. Areas that have floor drains shall not be required to meet the levelness tests.

3.6 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. 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.

E. Wood float surfaces receiving quarry tile, ceramic tile or terrazzo with full bed setting system.

F. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set quarry tile or thin set ceramic tile.

G. Steel trowel surfaces which are indicated to be exposed at interior spaces.

H. Concrete Slabs: Finish to requirements of ACI 302.1R and ACI SPEC-301, and as follows:

1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

2. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

I. Finish concrete floor surfaces in accordance with ACI SPEC-301.

3.7 CURING AND PROTECTION

A. Cure Concrete and floor surfaces in accordance with ACI SPEC-301.

B. Comply with requirements of ACI 308.1. 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.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

2. High early strength concrete: Not less than four days.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

E. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

   a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 7 days.

   b. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

   c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3. Final Curing: Begin after initial curing but before surface is dry.

   a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

   b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests.

B. 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.

C. The contractor shall be responsible for scheduling the tests. The contactor 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.

D. 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.

E. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

F. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

G. Concrete Inspections:

1. Continuous Placement Inspection: Inspect for proper installation procedures.

2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

H. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure five concrete test cylinders.

I. Strength Test Samples:

1. Sampling Procedures: ASTM C172/C172M

2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, 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.

5. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

J. Field Testing:

1. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

2. Slump Test Method: ASTM C143/C143M.

3. Air Content Test Method: ASTM C231/C231M for normal weight concrete or ASTM C173/C173M.

4. Temperature Test Method: ASTM C1064/C1064M.

5. Measure slump, density, and temperature for each compressive strength concrete sample.

6. Measure air content in air entrained concrete for each compressive strength concrete sample.

7. Density Testing ASTM C138/C138M.

K. Cylinder Compressive Strength Testing:

1. Test Method: ASTM C39/C39M.

2. Test Acceptance: In accordance with ACI SPEC-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.

L. Core Compressive Strength Testing: Notify Architect prior to core testing.

1. Sampling and Testing Procedures: ASTM C42/42M.

2. Test Acceptance: In accordance with ACI SPEC-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.

M. Test floor flatness and floor levelness per ASTM E1155. Floor levelness does not apply to unshored concrete slab-on-metal deck construction. Test structural floors prior to the removal of the formwork and shoring. Interpret and submit a summary of the test results with supporting data.

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

O. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

P. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

Q. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

R. The testing agency shall notify the Architect and Contractor of potentially deficient or deficient concrete.

3.9 PATCHING

A. Allow Architect to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect upon discovery.

C. Patch imperfections in accordance with ACI SPEC-301.

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect.

C. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 033000

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Engineered lumber framing.

C. Nonstructural dimension lumber framing.

D. Rough opening framing for doors, windows, and roof openings.

E. Sheathing.

F. Subflooring.

G. Roofing nailers.

H. Sill gaskets and flashings.

I. Preservative treated wood materials.

J. Fire retardant treated wood materials.

K. Miscellaneous framing and sheathing.

L. Communications and electrical room mounting boards.

M. Concealed wood blocking, nailers, and supports.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Setting anchors in concrete.

B. Section 061753 - Shop-Fabricated Wood Trusses.

C. Section 076000 – Flashing and Sheet Metal: Sill flashings.

D. Section 077200 - Roof Accessories: Prefabricated roof curbs.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel; 2021.

D. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a (Reapproved 2018).

E. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).

F. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

G. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products; 2021, with Editorial Revision.

H. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

K. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.

L. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.

M. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).

N. PS 1 - Structural Plywood; 2023.

O. PS 2 - Performance Standard for Wood Structural Panels; 2018.

P. PS 20 - American Softwood Lumber Standard; 2021.

1.4 SUBMITTALS

A. See Section 013300 – Submittals, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

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. Apply label from agency approved by authority having jurisdiction to identify each preservative-treated and fire-retardant-treated material.

C. 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.

D. Perform Work according to state and local standards.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Spruce-Pine-Fir, unless otherwise indicated.

2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.

3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (as indicated on the drawings):

1. Species: as indicated on the drawings.

2. Grade: as indicated on the drawings.

D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):

1. Species and Grades: As indicated on drawings for various locations.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2.

2. Boards: No. 2 or Standard Grade.

F. Treated Lumber: Southern Pine (SP) species, No. 2 grade, dimension lumber, 19 percent maximum moisture content, pressure-preservative treated, unless noted otherwise on the drawings.

2.3 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

C. Engineered Wood Products:

1. Manufactured with an exterior-type adhesive complying with ASTM D2559.

2. Evaluated and monitored according to ASTM D5456.

D. 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.

2.4 CONSTRUCTION PANELS

A. Subflooring: Plywood or oriented strand board wood structural panel; PS 1 or PS 2, rated Single Floor.

1. Bond Classification: Exposure 1.

2. Performance Category: As indicated on Drawings.

3. Span Rating: As indicated on Drawings.

4. Edges: Tongue and groove.

5. Surface Finish: Fully sanded face.

6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 300 days.

7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.

B. Roof Sheathing:

1. See Section 061613 – Composite Wall and Roof Sheathing

C. Wall Sheathing

1. See Section 061613 – Composite Wall and Roof Sheathing

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

2.5 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Nails: ASTM F1667/F1667M.

3. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

4. Anchors: Bolt or ballistic fastener for anchorages to steel.

5. Fasteners, Bolts and Lag Screws: Stainless steel for high-humidity and treated wood locations, unfinished steel elsewhere.

B. Structural Framing Connectors and Joist Hangers: galvanized steel, sized to suit framing conditions as indicated on the drawings.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

D. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.

1. Thickness: 68 mil, 0.068 inch.

2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

3. Water Vapor Permeance: 0.035 perm, maximum, when tested in accordance with ASTM E96/E96M.

E. Sill Flashing: See Section 076000 – Flashing and Sheet Metal

F. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.

G. Building Paper: ASTM D226; Type I, No. 15 unperforated asphalt felt.

2.6 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Chemically treated and pressure impregnated; having flame spread of 25 or less when tested according to ASTM E84 and showing no evidence of significant progressive combustion when test is continued for an additional 20-minute period; interior type.

2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

    b. Do not use fire treated wood in direct contact with the ground.

3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

    b. Treat rough carpentry items as indicated .

    c. Do not use fire treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.

    a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

    b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

2. Wood Preservative (Surface Application): Clear.

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 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.3 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

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

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

D. 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 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 use split members or members split at the connections.

4. Predrill members if required to prevent splitting.

5. Do not shim any framing component.

6. 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 Architect.

3.4 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span evenly spaced at 8 feet centers maximum. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on jack studs.

I. 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.

J. Set structural members level and plumb, in correct position.

K. Fasten framing according to applicable code.

L. Construct load-bearing framing full length without splices.

M. Install shear wall panels to comply with manufacturer's written instructions.

3.5 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing, blocking, and backing members as indicated or as required to support finishes, fixtures, specialty items, and trim for work of the other trades.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.6 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing. Glue and nail to framing; staples are not permitted.

1. Fully engage tongue-and-groove edge.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. At long edges use sheathing clips where joints occur between roof framing members.

2. Nail panels to framing; staples are not permitted.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails.

D. Place building paper horizontally over wall sheathing; weather lap edges and ends.

E. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.

3. Install adjacent boards without gaps.

4. Size back boards 12 inches beyond size of electrical panel.

F. Fasten sheathing according to the applicable code.

G. Install plywood and oriented strand board to two-span or more continuous.

H. Place plywood and oriented strand board with face grain perpendicular to supports and continuously over at least two supports, except where otherwise shown on the Drawings.

I. Center joints accurately over supports, unless otherwise shown on the Drawings.

J. Protect plywood and oriented strand board from moisture by use of waterproof coverings until the plywood in turn has been covered with the next succeeding component or finish.

3.7 FASTENING

A. Nailing Schedule: Unless otherwise directed by the Architect, comply with nailing requirements stipulated by the current edition of the International Building Code.

B. Nailing:

1. Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise specifically noted on the Drawings.

2. For conditions not covered in the Nailing Schedule provide penetration into the piece receiving the point of not less that ½ the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2" (nominal) thickness.

3. Nail without splitting wood.

4. Prebore as required.

5. Remove split members and replace with members complying with the specified requirements.

C. Bolting:

1. Drill holes 1/16" larger in diameter than the bolts being used.

2. Drill straight and true from one side only.

3. 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.

D. Screws:

1. For lag screws and wood screws, prebore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.

2. Screw, do not drive, lag screws and wood screws.

3.8 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Brush-apply one coat of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings, and masonry materials.

C. Treat Site-sawn cuts. Apply preservative to Site-sawn cuts according to AWPA M4.

D. Allow preservative to dry prior to erecting members.

3.9 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. Framing Members: 1/4 inch from true position, maximum.

C. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

D. Variation from Plane, Other than Floors: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.10 CLEANING

A. Waste Disposal: See Section 017400 – Cleaning

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061000

SECTION 061613 - COMPOSITE WALL AND ROOF SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-insulating composite wall and roof sheathing with integral water-resistive barrier and air barrier.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME): www.asme.org
   1. ASME B18.6.1 - Wood Screws (Inch Series)

B. ASTM International (ASTM): www.astm.org
   1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
   3. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
   4. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
   5. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
   6. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
   7. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
   8. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
   9. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

C. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355
   1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

D. International Code Council (ICC): www.iccsafe.org
   1. ICC IBC - International Building Code
   2. ICC IRC - International Residential Code for One and Two-Family Dwellings

E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org

   1. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
   2. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
   3. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
   4. ICC-ES AC201 - Acceptance Criteria for Staples
   5. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
   6. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers

7. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
8. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.

1.4 CLOSEOUT SUBMITTALS

A. Warranty: Executed copy of manufacturer special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.

B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.

C. Provide wall sheathing products meeting requirements of ICC-ES AC269.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.7 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.
   1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
   2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com. Alternatively, architect approved equal as part of alternate composite sheathing system. Wall composite sheathing to be 1/2" nominal thickness. Roof composite sheathing to be 5/8" nominal thickness.

B. Georgia Pacific Forcefield.

C. LP WeatherLogic.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.

B. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

C. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

2.3 MATERIALS

A. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

2.4 FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.
   1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

D. Wood Screws: ASME B18.6.1.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.
   1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape, 0.012 inch thickness.
   2. Architect approved equal as part of alternative composite sheathing system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

3.2 SHEATHING INSTALLATION

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate composite sheathing with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.

E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
   1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
   2. IBC: Table 2304.9.1 Fastening Schedule.
   3. IRC: Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments."

F. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

END OF SECTION 061613

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop-fabricated wood trusses.

B. Truss bridging.

1.2 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Installation requirements for miscellaneous framing.

B. Section 061000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.3 REFERENCE STANDARDS

A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2014.

B. SBCA (BCSI) - Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses; 2018 (Updated 2020).

1.4 SUBMITTALS

A. See Section 013300 - Submittals, for submittal procedures.

B. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.

1. Include identification of engineering software used for design.

2. Provide shop drawings stamped or sealed by design engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle trusses in accordance with SBCA (BCSI).

B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.1 TRUSSES

A. Wood Trusses: Design and fabricate trusses in accordance with ANSI/TPI 1 and to achieve specified design requirements indicated.

2.2 MATERIALS

A. Lumber:

1. Moisture Content: Between 7 and 9 percent.

2. Lumber fabricated from old growth timber is not permitted.

B. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

PART 3 EXECUTION

3.1 ERECTION

A. Install trusses in accordance with manufacturer's instructions, SBCA (BCSI); maintain a copy of applicable documents on site until installation is complete.

B. Set members level and plumb, in correct position.

C. Install permanent bridging and bracing.

3.2 TOLERANCES

A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION 061753

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Interior ships ladders and railings.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Interior standing and running trim.
2. Interior ships ladders and railings.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Softwood Plywood: DOC PS 1.

2.2 STANDING AND RUNNING TRIM AND SHIPS LADDER

A. Softwood Lumber Trim, 1x4 square stock trim boards.

1. Species and Grade: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice); NeLMA, NLGA, or WWPA.
2. Maximum Moisture Content: 15 percent.

2.3 SHIPS LADDERS AND RAILINGS

A. Treads: 2x dimensional lumber (see drawings for width dimensions).

B. Risers: None.

C. Interior Railings: 2x6 dimensional lumber.

D. Balusters / Newel Post: 2x6 dimensional lumber.

2.4 MISCELLANEOUS MATERIALS

A. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue.

1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset.
4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

3.4 SHIPS LADDER AND RAILING INSTALLATION

A. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to rough carriages.
1. Open Stringers: Extend tread over open stringers and finish with bullnose edge.

B. Balusters: Dovetail or mortise balusters into treads, glue, and nail in place. Let into railings and glue in place.

C. Newel Posts: Secure newel posts to stringers, rough carriages, and risers with countersunk-head wood screws and glue.

D. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts, and glue. Assemble railings at goosenecks, easements, and splices with rail bolts and glue.

END OF SECTION 062023

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Perimeter insulation under slabs-on-grade.
2. Perimeter wall insulation (supporting backfill).
3. Cavity-wall insulation.
4. Vapor retarders.
5. Foamed In-Place Insulation

1.2 SUBMITTALS

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

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product test reports.

D. Research/Evaluation Reports: For foam-plastic insulation.

1.3 QUALITY ASSURANCE

A. Retain ASTM test method below based on product and kind of fire-resistance characteristic specified for each product in Part 2. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft., with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Available Manufacturers:

   a. DiversiFoam Products.
   b. Dow Chemical Company.
   c. Owens Corning.
   d. Pactiv Building Products Division.

2.3 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. Wall cavity: 5-1/2 inches thick (R-20) with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F.
2. Roof cavity: 14 inches thick (R-49) with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F.

2.4 VAPOR RETARDERS

A. Vapor barrier at concrete floor slab shall have all of the following qualities:

1. Maintain permeance of less than 0.03 Perms [grains/(ft2 - hr - inHg)] as tested in accordance with mandatory conditioning test per ASTM eq745 Section 7.1 (7.1.1-7.1.5)
2. Other performance criteria:

   a. Strength: ASTM E1745 Class A.
   b. Thickness: 15 mils minimum

3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:

1. Basis-Of-Design: Stego Wrap Class A Vapor Retarder (10-mil) by Stego Inductries LLC., (877) 464-7834 www.stegoindustries.com, or comparable product by one of the following:

   a. Raven Industries Inc., DURA – SKRIM.

b. Reef Industries Inc., Griffolyn.

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

D. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

E. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

F. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.5 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.3 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.4 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated.

B. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.5 INSTALLATION OF FOAMED IN-PLACE INSULATION

A. Examination

1. Verify existing conditions are ready to receive work.
2. Beginning of application implies acceptance of existing conditions.

A. Preparation

1. Apply required primers for special conditions as recommended by manufacturer.

C. Application

1. Apply in accordance with ASTM C1029 and manufacturer's installation guidelines.

END OF SECTION 072100

SECTION 074113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels.

B. Related Sections:

1. Division 07 Section "Sheet Metal Roofing" for custom-fabricated and on-site, roll-formed sheet metal roofing.

1.2 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

C. Samples: For each type of exposed finish required.

D. Maintenance data.

E. Warranties: Samples of special warranties.

1.3 PERFORMANCE REQUIREMENTS

A. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL90.

C. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure of 20 lbf/sq. ft., acting inward or outward.

2. Snow Loads: 20 lbf/sq. ft.
3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than [1/180] of the span.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness 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, G90 coating designation; structural quality.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:

a. Kynar 500 resin-based finish system.

4. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
    b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
    c. Metal-Fab Manufacturing, LLC; MetShield.
    d. Owens Corning; WeatherLock Metal High Temperature Underlayment.
    e. Architect approved equal.

B. Felts: ASTM D 226, No. 15, asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. 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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Aluminum Corporation Snap-On Batten Seam Panel, or comparable product by one of the following:

    a. AEP-Span.
    b. CENTRIA Architectural Systems.
    c. MBCI; a division of NCI Building Systems, L. P.
    d. Metecno-Morin; Division of Metecno Inc.
    e. Architect Approved Equal.

4. Profile: Vertical-rib, snap.
5. Material: Zinc-coated (galvanized) steel sheet, 24 gauge thickness.

    a. Exterior Finish: : Kynar 500 resin-based finish system.
    b. Color: As selected by Architect from manufacturer's full range.

6. Clips: Floating to accommodate thermal movement.

a. Material: Metallic coated steel.

7. Joint Type: As standard with manufacturer.
8. Panel Coverage: 18” nominal panel width.
9. Panel Height: 1” nominal height.

2.5 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof 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 roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.6 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

B. Felt Underlayment: Apply at locations indicated on Drawings, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

C. Apply slip sheet if required by manufacturer over underlayment before installing metal roof panels.

D. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.3 METAL ROOF PANEL INSTALLATION

A. 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. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.4 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. 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.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.
2. Metal soffit panels.

1.2 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

C. Samples: For each type of exposed finish required.

D. Maintenance data.

E. Warranties: Samples of special warranties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness 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, G90 coating designation; structural quality.
2. Surface: Smooth, flat finish.
3. Exposed Coil-Coated Finish:

    a. Kynar 500 resin-based finish system.

4. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920 as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Wall Panel #1 as Petersen Aluminum Corporation Precision board and Batten, and provide Wall Panel #2 as Petersen Aluminum Corporation Precision Series HWP steel siding panels, or comparable product by one of the following:

    a. AEP-Span.
    b. CENTRIA Architectural Systems.
    c. MBCI; Div. of NCI Building Systems.
    d. Metecno-Morin.
    e. Architect approved equal.

3. Profile: Wall Panel #1 to be Board and Batten; Wall Panel #2 to be Tapered Rib.
4. Material: Zinc-coated (galvanized) steel sheet, 24 Gauge.

    a. Exterior Finish: Kynar 500 resin-based finish system.
    b. Color: As selected by Architect from manufacturer's full range.

5. Panel Coverage: Wall Panel #1 @ 12" nominal panel width; Wall Panel #2 @ 16" nominal panel width.
6. Panel Height: 7/8" nominal panel height.

2.4 METAL SOFFIT PANELS

A. Provide factory-formed perforated metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels

1. Finish: Match finish and color of metal wall panels.
2. Sealant: Factory applied within interlocking joint.
3. 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:
4. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Aluminum Corporation PAC 750 Series non-vented aluminum w/ pencil rib, or comparable product by one of the following:

    a. AEP-Span.
    b. CENTRIA Architectural Systems.
    c. MBCI; Div. of NCI Building Systems.
    d. McElroy Metal, Inc.
    e. Architect approved equal.

5. Soffit Panel #1 and Soffit Panel #2 as indicated on the drawings will be identical panels, varying only in color.
6. Profile: V groove.
7. Material: Aluminum panels.
8. Material: Aluminum-zinc alloy-coated steel sheet, 0.032-inch.

    a. Exterior Finish: Kynar 500 resin-based finish system.
    b. Color: Match finish and color of metal wall panels.

9. Panel Coverage: 12" nominal panel width.
10. Panel Height: 1/2" nominal panel height.

2.5 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, 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 metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.6 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.2 METAL WALL PANEL INSTALLATION

A. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

B. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

C. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.3 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 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.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 074213

SECTION 076000 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through the exterior shell of the building.

B. This section also includes the following:
   1. Gutters & Downspouts

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 013300.

B. Product data: Within 45 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;
   3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
   4. Manufacturer's recommended installation procedures which, when approved by the Engineer/Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen 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. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in current edition of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

C. Standard commercial items may be used for flashing, trim, reglets, and similar purposes provided such items meet or exceed the quality standards specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent provisions of Section 016600 Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.1 MATERIALS AND GAGES

A. Where sheet metal is required, and no material or gage is indicated on the Drawings, provide the highest quality and gauge commensurate with the referenced standards.

2.2 GALVANIZED IRON

A. Provide sheet metal or sheet iron of a standard brand of open-hearth copper-bearing steel, copper-molybdenum iron, or pure iron sheets.

B. Zinc coating:
   1. Where galvanizing is required, provide zinc coating by hot-dip galvanize to all surfaces.
   2. Weight:
      a. Provide not less than 1-1/4 oz per sq. ft., nor more than 1-1/2 oz per sq. ft. To surfaces required to be galvanized.
   3. Comply with ASTM A123-84.

2.3 NAILS, RIVETS, AND FASTENERS

A. Use only soft iron rivets having rust-resistive coating, galvanized nails, and cadmium plated screws and washers in connection with galvanized iron and steel.

2.4 FLUX

A. Where flux is required, use raw muriatic acid.

2.5 SOLDER

A. Where solder is required, comply with ASTM B32.

2.6 PREFINISHED ALUMINUM GUTTER AND DOWNSPOUT

A. Gutter – Provide 6”x6” prefinished aluminum gutter with manufacturer’s bracket system.

   1. Acceptable Manufacturers:
      a. Metal-Era #IGG3-C6
      b. Petersen Aluminum Corporation (PAC)
      c. SAF (Southern Aluminum Finishing)
      d. Architect Approved Equal

B. Downspouts – Provide prefinished 4” nominal rectangular aluminum downspouts

   1. Acceptable Manufacturers:
      a. Metal Era – Industrial Downspout, Closed Face Version, Style A.
      b. Petersen Aluminum Corporation (PAC)
      c. SAF (Southern Aluminum Finishing)
      b. Architect Approved Equal

2.8 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer/Architect.

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 WORKMANSHIP

A. General
   1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and where intercepting other members, coping to an accurate fit and soldering securely.
   2. Unless otherwise specifically permitted by the Engineer/Architect, turn exposed edges back 1/2”.

B. Form, fabricate, and install sheet metal so as to adequately provide for expansion and contraction in the finished work.

C. Weatherproofing
   1. Finish watertight and weathertight where so required.
   2. Make lock seam work flat and true to line, sweating full of solder.
   3. Make lock seams and lap seams, when soldered, at least 1/2” wide.
   4. Where lap seams are not soldered, lap according to pitch, but in no case less than 3."
   5. Make flat and lap seams in the direction of flow.

D. Joints:
   1. Join parts with rivets or sheet metal screws where necessary for strength and stiffness.
   2. Provide suitable watertight expansion joints for runs of more than 40’-0”, except where closer spacing is indicated on the Drawings or required for proper installation.

E. Nailing:
   1. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.
   2. In general, space nails, rivets, and screws not more than 8” apart and, where exposed to the weather, use lead washers.
   3. For nailing into wood, use barbed roofing nails 1-1/4” long by 11 gage.
   4. For nailing into concrete, use drilled plugholes and plugs.

3.3 EMBEDMENT

A. Embed metal in connection with roofs in a solid bed of sealant, using materials and methods described in Section 079200 of these Specifications or other materials and methods approved in advance by the Engineer/Architect.

3.4 TESTS

A. Upon request of the Engineer/Architect, demonstrate by hose or standing water that the flashing and sheet metal are completely watertight.

END OF SECTION 076000

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Snow retention system that clamps directly to the stand seams without penetrating the roof system.
2. Coordinate with the installation of the metal roofing system to assure the proper fastening of the metal roof to the substructure.
3. Provide all necessary components: Clamps, Brackets, Bars, Set Screws, End Caps and Ice Stoppers.

1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated.

B. Shop Drawings: Show fabrication and installation details for roof accessories.

C. Samples: For each type of exposed factory-applied finish required.

1.3 QUALITY ASSURANCE

A. Installer to be experienced in the installation of standing seam metal roofing and snow retention systems.

1.4 DELIVERY / STORAGE / HANDLING

A. Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed.

1.5 DESIGN REQUIREMENTS

A. Clamps must me used at roof seams as required by the manufacturer design.

B. Snow retention system should have a minimum performance of 500 pounds per linear foot of bar without deflection and 500 pounds per clamp without significantly damaging the roof panel or seam.

C. Based on snow load, climatic condition, length of roof panel and width of panel; multiple rows of snow retention may be needed.

D. Provide attachment of system without voiding roof panel warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed.

1. Basis of design: MCBI, a division of MCI Building Systems, LP
2. SnoBar, by Action Manufacturing, as distributed by Snoblox-Snojax.
3. Apline SnowGuards
4. Equal product as approved by architect.

2.2 MATERIALS

A. Clamps: 12 Ga. One-piece stainless steel clamp with 2 “cup tipped” stainless steel set screws installed as recommended by the manufacturer.

B. Bars: 1-inch square 16 Ga. Galvanized Steel Bar

2.3 FINISH

A. Powder Coat – color to match or be similar to metal roof as selected by the architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
4. Interior joints in horizontal traffic surfaces.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Preconstruction field test reports.

D. Compatibility and adhesion test reports.

E. Product test reports.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 and in accordance with manufacturer’s field adhesion test procedure (see Section 1.5.B); each that is appropriate for the types of Project joints.

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.5 WARRANTY

A. Special installer's warranty for sealant installed at exterior side of precast concrete wall panel joints: 5 years period from date of Substantial Completion.

B. Special manufacturer's warranty for sealant installed exterior side of precast concrete wall panel joints: 20 years from date of Substantial Completion (upon documentation of field adhesion tests as per the manufacturers field adhesion test procedure).

C. Special Installer's Warranty for other sealants: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

D. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Neutral and Basic-Curing Silicone Sealant:

1. Products:

    a. Dow Corning Corporation; 790.
    b. Tremco; Spectrem 1.
    c. Pecora Corporation; 890.
    d. GE Silicones; SilPruf NB SCS9000 NB.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

6. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.

E. Single-Component Neutral-Curing Silicone Sealant:

1. Products:

    a. Dow Corning Corporation; 799.
    b. GE Silicones; UltraGlaze SSG4000.
    c. GE Silicones; UltraGlaze SSG4000AC.
    d. Tremco; Proglaze SG.
    e. Tremco; Spectrem 2.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Products:

    a. Pecora Corporation; 898.
    b. Tremco; Tremsil 600 White.
    c. Dow (DOWSIL); 795 Silicone Building Sealant.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

G. Single-Component Nonsag Urethane Sealant:

1. Products:

   a. Sika Corporation, Inc.; Sikaflex - 1a.
   b. Sonneborn, Division of ChemRex Inc.; Ultra.
   c. Sonneborn, Division of ChemRex Inc.; NP 1.
   d. Tremco; Vulkem 116.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,**] A, and, as applicable to joint substrates indicated, O.

H. Single-Component Pourable Urethane Sealant:

1. Products:

   a. Sika Corporation, Inc.; Sikaflex - 1CSL.
   b. Sonneborn, Division of ChemRex Inc.; SL 1.
   c. Tremco; Vulkem Nova 300 SSL.

2. Type and Grade: S (single component) and P (pourable).
3. Class: 50.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,**] A, and, as applicable to joint substrates indicated, O.

I. Single-Component Pourable Urethane Sealant:

1. Products:

   a. Bostik Findley; Chem-Calk 950.
   b. Pecora Corporation; Urexpan NR-201.
   c. Polymeric Systems Inc.; Flexiprene 952.
   d. Schnee-Morehead, Inc.; Permathane SM7101.
   e. Tremco; Tremflex S/L.
   f. Tremco; Vulkem 45.

2. Type and Grade: S (single component) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, [**G,**] A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type O P, Grade NF.

B. Products:

1. Pecora Corporation; AC-20+.
2. Schnee-Morehead, Inc.; SM 8200.
3. Sonneborn, Division of ChemRex Inc.; Sonolac.
4. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. Tremco; Tremco Acoustical Sealant

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Available Products:

a. Pecora Corporation; BA-98.
b. Tremco; Tremco Acoustical Sealant.
c. PABCO Gypsum; Quiet Seal Pro.

2.6 TAMPER PROOF SEALANTS

A. One component, non-sag, polyurethane sealant for tamper proof applications.

1. Available Products:

a. Tremco HPL Sealant
b. Pecora DynaFlex SC
c. BASF MasterSeal CR 195

2.7 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products:

a. Dow Corning Corporation; 123 Silicone Seal.
b. GE Silicones; UltraSpan US1100.
c. Pecora Corporation; Sil-Span.
d. Tremco; Spectrem Ez Seal.

B. Pre-Compressed Foam Sealants: Manufacturer's standard mildew-resistant, non-migratory, preformed, pre-compressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent. Custom size ¾" x 2" for precast concrete wall panel joints.

1. Provide following product or equal product that meets specified performance criteria in this section:

   a. EMSEAL Joint Systems, Ltd.; Backerseal.
   b. Sika Corporatoin; Sika Emseal Emshield DFR/TH.
   c. Illbruck (Tremco CPG); TP600 Compriband

2. Pre-compressed sealant shall be pre-formed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, polymer-modified 100% acrylic dispersion.
3. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size.
4. At precast concrete joints, pre-compressed sealant to be installed in two layers as shown on drawings at depth sufficient to allow installation of properly sized backer rod and liquid sealant in front of material.
5. Pre-Compressed foam sealant must be supplied pre-compressed to less than the joint size, packaged in reels or shrink-wrapped lengths (sticks) with a mounting adhesive on one face, for ease of installation.

2.8 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26°F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

    a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.

    a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.

H. Installation of Pre-Compressed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. Install in complete accordance with sealant manufacturer's written instructions. No drilling, or screwing, or fasteners of any type are permitted to anchor the system into the substrate.

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

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior vertical and horizontal non-traffic construction joints in cast-in-place concrete.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.

2. Joint-Sealant Color: Custom color as selected by Architect.

B. Joint-Sealant Application: Exterior vertical and horizontal non-traffic joints between plant-precast architectural concrete wall panels.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.
2. Joint-Sealant Color: Custom color as selected by Architect.

C. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.
2. Joint-Sealant Color: Custom color as selected by Architect.

D. Joint-Sealant Application: Exterior butt joints between metal panels.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
2. Joint-Sealant Color: Custom color as selected by Architect.

E. Joint-Sealant Application: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Single-component neutral-curing silicone sealant] [Single-component neutral-curing silicone sealant.
2. Joint-Sealant Color: Custom color as selected by Architect.

F. Joint-Sealant Application: Exterior perimeter joints at frames of doors, windows and louvers.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
2. Joint-Sealant Color: Custom color as selected by Architect.

G. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint Sealant: Single-component non-sag urethane sealant
2. Joint-Sealant Color: From manufacturer’s standard color chart.

H. Joint-Sealant Application: Interior perimeter joints of exterior openings.

1. Joint Sealant: Single-component non-sag urethane sealant.
2. Joint-Sealant Color: From manufacturer’s standard color chart.

I. Joint-Sealant Application: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: Multicomponent non-sag urethane sealant, Multicomponent pourable urethane sealant or Single-component pourable urethane sealant.
2. Joint-Sealant Color: From manufacturer’s standard color chart.

J. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.
2. Joint-Sealant Color: From manufacturer’s standard color chart.

K. Joint-Sealant Application: Vertical joints on exposed surfaces of interior walls and partitions.

1. Joint Sealant: Multicomponent non-sag urethane sealant, Single-component non-sag urethane sealant or Latex sealant.
2. Joint-Sealant Color: From manufacturer's standard color chart.

L. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: From manufacturer's standard color chart.

M. Joint-Sealant Application: Interior control, expansion, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: Multicomponent non-sag urethane sealant, Multicomponent pourable urethane sealant or Single-component pourable urethane sealant.
2. Joint-Sealant Color: From manufacturer's standard color chart.

END OF SECTION 079200

SECTION 081433 - STILE AND RAIL WOOD COMPOSITE DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stile and rail wood composite doors.

1.2 REFERENCE STANDARDS

A. Architectural Woodwork Institute:

1. AWI AWS - Architectural Woodwork Standards.

B. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. Forest Stewardship Council:

1. FSC Guidelines - Forest Stewardship Council Guidelines.

D. Hardwood Plywood and Veneer Association:

1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. National Fire Protection Association:

1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

F. Underwriters Laboratories Inc.:

1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
2. UL 1784 - Air Leakage Tests of Door Assemblies.

G. Wood Window and Door Manufacturers Association:

1. WDMA I.S 1A - Architectural Wood Flush Doors.

1.3 COORDINATION

A. Coordinate Work with door opening construction, door frame and door hardware installation.

B. Coordinate Work of this section and as specified in related section.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit data for door core materials and construction.
2. Submit data for face species, type and characteristics.
3. Submit data for factory finishes.

C. Shop Drawings:

1. Illustrate door opening criteria, elevations, sizes, types, swings, special beveling, and factory machining criteria.

D. Samples:

1. Submit two samples of door construction, 12x12 inch in size cut from top corner of door.
2. Submit two samples of door finish, 12x12 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturers' Instructions: Submit special installation instructions.

F. Qualification Statements:

1. Submit manufacturer experience qualifications.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWI AWS Section 9; Premium Grade.

B. Finish doors in accordance with AWI AWS Section 5; Premium Grade].

C. Perform Work in accordance with specified building codes and manufacture’s standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Product storage and handling requirements.

1. Break seal on site to permit ventilation.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

1. Break seal on site to permit ventilation.

1.8 WARRANTY

A. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

B. Interior Doors:

1. Factory Finished Doors: Furnish manufacturer's life of installation warranty.
2. Field Finished Doors: Furnish manufacturer's two (2) year warranty.

PART 2 - PRODUCTS

2.1 STILE AND RAIL WOOD DOORS

A. Manufacturers: Basis of Design "Masonite Lincoln Park 1 Panel", or equivalent product by one of the following manufacturers, or equivalent product as approved by Architect.

1. Algoma Hardwoods, Inc.
2. Eggers Industries
3. VT Industries, Inc.
4. Maiman Five Architectural Doors, An ASSA ABLOY Group Company
5. Substitutions: Equal product as approved by Architect.

2.2 MATERIALS

A. Door Cores: AWI AWS Section 9.

1. Solid Core, Non-Fire Rated:

a. Type: SLC; staved lumber.
b. Type: SCL; structural composite lumber.

B. Interior Door Faces:

1. Opaque Finished Solid Stock Faces: wood fiber and resin over close-grain hardwood.

C. Adhesive: Type II, water resistant..

2.3 FABRICATION

A. Fabricate doors in accordance with AWI AWS Section 9 requirements.

1. Fabricate stiles and rails with ogee sticking profile.
2. Assemble with glued mortise and tenon or doweled joints.

B. Bond panel edge rim banding to cores.

C. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

D. Factory fit doors for frame opening dimensions identified on shop drawings.

E. Provide edge clearances in accordance with AWI AWS Section 9.

2.4 FINISHES

A. Finish work in accordance with AWI AWS Section 5; Custom Grade.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify opening sizes and tolerances are acceptable.

B. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with AWI AWS Section 9 and manufacturer's instructions.

B. Field Fitting and Trimming:

1. Trim non-rated door width by cutting equally on both jamb edges.
2. Trim door height by cutting bottom edges to maximum of 3/4 inch.

    a. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

3. Machine cut for hardware installation.

3.3 TOLERANCES

A. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over imaginary 36 x 84 inch surface area.

B. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over imaginary 36 x 84 inch surface area.

C. Maximum Width Distortion (Cup): [1/8] inch measured with straight edge or taut string, edge to edge, over imaginary 36 x 84 inch surface area.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

B. Adjust door closer for full closure.

END OF SECTION 081433

SECTION 082200 - FIBERGLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Standards for manufacturing, machining, finishing and installation of non-fire-rated fiberglass doors and frames unless more specifically described under other section(s).

1.2 SUBMITTALS

A. Shop Drawings

1. Shop and erection drawings of all fabricated and milled items.

1.3 QUALITY ASSURANCE

A. Provide doors and frames meeting or exceeding the minimum standards as set forth by the following organizations unless standards are modified or exceeded by this specification:

1. Composite Fabricators Association (CFA).
2. Composites Institute

B. All doors shall be the products of the same manufacturer to insure uniformity of quality and appearance throughout the project.

C. The top of each door shall bear a bar code label from the manufacturer indicating the door serial number, date(s) of manufacture, size and type.

D. The door manufacturer shall provide a Certification of Compliance with this specification signed by an authorized company representative.

1.4 DELIVERY AND STORAGE

A. Deliver all materials to job site and store in a manner to prevent damage.

1.5 WARRANTY

A. Provide manufacturer’s lifetime warranty against failure due to corrosion from the specific environment named at the time of purchase.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Manufacturers

1. Basis of Design: Mechanical Room Exterior Door to be “Masonite Lincoln Park 1 Panel” (fiberglass); Entry Door to be “Masonite Full Lite” (fiberglass). Listed manufacturers are believed to conform to the criteria stated for material quality standards, function and appearance. Manufacturers are still subject to meeting the requirements of this specification. Equivalent products are subject approval by Architect. Non-conforming substitutions shall not be accepted.

    a. Corguard by Oshkosh Door Company
    b. Corrim Door Company, Inc.
    c. Simon Door Co., LLC

2.2 MATERIALS AND COMPONENTS

A. Core

1. Cores for non-fire-rated doors shall be injected, closed cell, polyurethane foam with a density of 4 pounds per square foot. Foam shall be injected into the door cavity while the door is in a press. Foam shall be allowed to cure in place prior to door being removed from the press. The use of drop in foam cores shall be prohibited.
2. Cores for fire-rated doors shall be mineral core.

B. Stiles and Rails

1. Stiles and rails shall be fiberglass and manufactured by the pultrusion process. Outside dimensions shall conform to hardware reinforcement requirements and overall door thickness of 1.75 inches. Resin and reinforcement selection shall be compatible with door facing material.

C. Door Face Skins

1. Door face skins shall consist of a Fiberglass Laminate manufactured by the Resin Transfer Molding (RTM) process. Skin thickness shall be 0.125 inches.

    a. Gel Coat and resin selection: Gel coat and resin shall be selected to withstand the installed environment. Both UV and corrosion resistance shall be considered paramount.
    b. Reinforcements shall be either type “A” or “C” glass. The use of “E” glass roving shall be strictly prohibited.
    c. Prefinished color as selected by architect from manufacturer’s full range.

D. Fiberglass Frames

1. Constructed of 0.1875 inch thick Fiberglass pultrusions:

    a. Jamb depths and faces (including noted 4” heads) as indicated by drawing details and/or door and frame schedule on drawings.
    b. Provide frames with mitered corners, resin welded and ground smooth unless specifically noted otherwise.
    c. Reinforcings:
        1) Corner Reinforcement: 4”x4”x5-3/8”x1/4” pultruded fiberglass angle.
        2) Strike Reinforcement: 1-1/2” x 8” x 3/4” thick polymer material.
        3) Closer Reinforcement: 1-1/8”x18”x1/4” polymer bonded to frame.
        4) Provide adequate reinforcings for other hardware as required in approved finish hardware schedule.

2. Provide proper type base and jamb anchors for all frames.

   a. Provide standard rubber silencers, 3 per strike jamb and 2 per head jamb for pairs.

3. Prefinished color as selected by architect from manufacturer's full range.

2.3 ACCESSORIES

A. Provide all required accessories for proper assembly and installation, including but not limited to, stainless steel screws, clips, washers, bolts, anchors, splice plates, spacers, and similar items, whether specifically mentioned herein or not.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate all doors and accessories in strict accordance with this specification and Door Manufacturer's manufacturing specifications.

3.2 INSTALLATION

A. Install doors and frames plumb, rigid, properly aligned and securely fastened in place. Install in accordance with manufacturer's instructions and NFPA 80 standards at fire rated openings.

B. Where applicable, set frames in place prior to construction of enclosing walls and ceilings. Space between wall and frame may be solidly filled with mortar and anchors built into the joints as the walls are constructed.

C. Check plumb, squareness and twist of frames as walls are constructed. Brace securely until permanently anchored. Shim as necessary to comply with installation tolerances.

D. Remove temporary braces and spreaders necessary for installation only after frames have been properly set and secured.

E. Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows: 1) Three anchors per jamb from 60 to 90 inches in height, (2) Four anchors per jamb from 90 to 96 inches in height.

F. Protect frames during construction.

G. Align doors in frames for uniform clearances at each edge.

3.3 MACHINING AND FITTING

A. All fiberglass doors shall be machined by the manufacturer or authorized manufacturer for cutouts, hinges, locks, closures and all hardware requiring routing and mortising. Doors shall be sized to allow 0.125 inches of clearance at top and each side and 5/8 inch clearance at bottom (unless specified otherwise).

3.4 INSTALLATION OF HARDWARE

A. Contractor shall install hardware according to approved hardware schedule for proper locations.

B. Install with full threaded screw furnished by hardware manufacturer.

C. Drill proper size pilot holes for all screws.

D. Securely anchor hardware in correct position and proper alignment.

E. Adjust hardware and door for proper function and smooth operation, proper latching, without force or excessive clearance.

3.5 ADJUSTING

A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.

END OF SECTION 082200

SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes aluminum-clad, wood-framed casement windows.

1.2 SUBMITTALS

A. Product Data: For each type of wood window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.

C. Samples: For each exposed finish.

D. Product Schedule: Use same designations indicated on Drawings.

E. Product test reports.

F. Maintenance data.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size required by AAMA/WDMA 101/I.S.2/NAFS.

B. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

    a. Basic Wind Speed: 90 mph.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.

B. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: Two years from date of Substantial Completion.
b. Glazing: Five years from date of Substantial Completion.
c. Metal Finish: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Crestline Elite Aluminum Clad Wood Casement Windows. Nominal window size on drawings is 30-inches wide by 44-inches tall. Window size may vary slightly per manufacturer, and may be acceptable upon review and approval by architect. Subject to compliance with requirements, provide or a comparable product by one of the following:

1. Aluminum-Clad Wood Windows:

a. BiltBest Windows and Patio Doors.
b. Crestline; a brand of Peachtree Companies, Inc. (The); TPC Acquisition, Inc.
c. EAGLE Window & Door, Inc.; an American Architectural Products Corporation Company.
d. Hurd Millwork Company.
e. Kolbe & Kolbe Millwork Co., Inc.
f. Marvin Windows and Doors.

g. Norco Premium Collection; JELD-WEN, Inc.
h. Peachtree Doors and Windows; TPC Acquisition, Inc.
i. Pella Corporation.
j. Pozzi Custom Collection; JELD-WEN, Inc.
k. Sierra Pacific Windows.
l. Vetter; TPC Acquisition, Inc.
m. Weather Shield Mfg., Inc.

2.2 MATERIALS

A. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

B. Aluminum Extrusions and Rolled Aluminum for Cladding, Baked-Enamel Finish: Manufacturer's standard baked enamel complying with AAMA 2603 or AAMA 620.

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

2.3 WINDOWS

A. Window Type: Casement.

B. Comply with AAMA/WDMA 101/I.S.2/NAFS.

C. Condensation-Resistance Factor (CRF): Provide wood windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

D. Thermal Transmittance: Provide wood windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.

1. U-Factor: 0.55 Btu/sq. ft. x h x deg F or less.

E. Solar Heat-Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.70, determined according to NFRC 200 procedures.

2.4 GLAZING

A. Glass: Double Pane, Clear, insulating-glass with low-E coating pyrolytic on second surface or sputtered on second surface.

2.5 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside of window and provide for each operable exterior sash or ventilator.

1. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 class.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners.

2.6 FABRICATION

A. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

B. Factory machine windows for openings and for hardware that is not surface applied.

C. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

G. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

H. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085200

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed, formed-metal louvers.
2. Wall vent louvers.
3. Soffit vent louvers.

1.2 SUBMITTALS

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

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Test Reports: Based on tests performed according to AMCA 500-L.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
2. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
3. For fastening stainless steel, use 300 series stainless-steel fasteners.
4. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, FORMED-METAL LOUVERS

A. Horizontal, Drainable-Blade Louvers: LV-1 @ 3” tall x 12” wide.

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

a. Air Balance Inc.; a Mestek company.
b. Air Flow Company, Inc.
c. Airolite Company, LLC (The).
d. American Warming and Ventilating, Inc.; a Mestek company.
e. Arrow United Industries; a division of Mestek, Inc.
f. Cesco Products; a division of Mestek, Inc.
g. Construction Specialties, Inc.
h. Dowco Products Group; Safe-Air of Illinois, Inc.
i. Greenheck Fan Corporation.
j. Industrial Louvers, Inc.
k. Metal Form Manufacturing Inc.
l. NCA Manufacturing, Inc.
m. Ruskin Company; Tomkins PLC.
n. United Enertech Corp.
o. Vent Products Company, Inc.

2. Louver Depth: 4 inches.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

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

2.6 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

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

2.7 STAINLESS-STEEL SHEET FINISHES

A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION 089000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. 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.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: 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.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Gypsum Co.
    b. BPB America Inc.
    c. G-P Gypsum.
    d. Lafarge North America Inc.
    e. National Gypsum Company.
    f. PABCO Gypsum.
    g. Temple.
    h. USG Corporation.

B. Ceilings: Ultralight, sag-resistant to allow structural member spacing up to 24” O.C.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

C. Walls: Abuse-Resistant Type. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board oisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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, rounded or beveled panel edges, 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 setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.4 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.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 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- to 1/2-inch- 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.

D. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.2 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. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

3.3 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, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.4 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, 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

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Resilient tile flooring.

1.2 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Provide data on specified products, describing physical characteristics; sizes, patterns and colors available.

C. Samples: Submit samples, illustrating color and pattern for each floor material.

1.3 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM F1066 - Vinyl Composition Floor Tile.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 016600

1.5 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

PART 2 - PRODUCTS

2.1 MATERIALS - RESILIENT FLOORING

A. Luxury Vinyl Composition Tile, Basis of Design: “Karndean Grey Artisan Oak RL33”.

1. Size: 48 x 7 inch.
2. Thickness: 3mm.
3. Design: grey, wood pattern
4. Glue-down.
5. Manufacturers:

a. Armstrong, Standard Excelon.
b. Azrock, Custom Cortina.
c. Mannington, Essentials.
d. Tarkett, Basic Structures.
e. Equivalent product as approved by Architect.

2.2 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.

B. Verify floor surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place; press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Install tile to square grid pattern with all joints aligned. Allow minimum 1/2 full size tile width at room or area perimeter.

G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

H. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 CLEANING

A. Clean work under provisions of 017400.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

3.5 PROTECTION OF FINISHED WORK

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION 096500

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Provide complete, in place, the painting work for the project, as shown, noted, or scheduled on the drawings and as specified herein.

1.2 SUBMITTALS

A. In accord with 013300:

1. Product data:

a. Materials list of items proposed to be provided under this Section;
b. Manufacturer's specifications and other data as needed to prove compliance with the specified requirements;
c. Color schedule for selection of colors.

1.3 RELATED WORK

A. 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.

B. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.

1.4 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. Paint coordination:

1. Provide finish coats which are compatible with the prime coats actually used.
2. Review other Sections of these Specifications as required, verifying the prime coat to be used and assuring compatibility of the total coating system for the various substrata.
3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
5. Notify the Architect/Engineer in writing of anticipated problems in using the specified coating systems over prime-coatings supplied under other Sections.

1.5 PRODUCT STORAGE & PROTECTION

A. Comply with pertinent provisions of Section 016600.

1.6 JOB CONDITIONS

A. Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degrees F, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect/Engineer.

B. Weather conditions:

1. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect/Engineer.
2. Applications may be continued during inclement weather only within the temperature limits specified by the paint manufacturer as being suitable for use during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

A. Acceptable Materials: Paints, Stains and Coatings shall be first line products of Sherwin Williams, Tnemec, PPG Architectural Finishes, Benjamin Moore Paints, or other manufacturers approved by the Architect/Engineer.

B. Undercoats and thinners:

1. Provide undercoat paint produced by the same manufacturer as the finish coat.
2. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.
3. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

2.2 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect/Engineer.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

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 MATERIALS PREPARATION

A. General:

1. Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Architect/Engineer.
2. When materials are not in use, store in tightly covered containers.
3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.
4. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain the material before using.

3.3 SURFACE PREPARATION

A. General:

1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Architect/Engineer.
2. Remove removable items, which are in place and are not scheduled to receive paint finish; or provide surface-applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workers who are skilled in the necessary trades.
4. Clean each surface to be painted prior to applying paint of surface treatment.
5. Remove oil and grease with clean cloths and cleaning solvent of low toxicity and flash point in excess of 200 degrees F, prior to start of mechanical cleaning.
6. Remove existing paint that is loose.

B. Preparation of all new and noted existing wood surfaces to receive paint or stain/varnish:

1. Clean wood surfaces until free from dirt, oil, loose paint, and other foreign substance.
2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
3. Unless specifically approved by the Architect, do not proceed with finishing of wood surfaces until the moisture content of the wood Architect/Engineer is 14% or less as measured by a moisture meter approved by the Architect/Engineer.

C. Preparation of all new and noted existing metal surfaces to receive paint:

1. Thoroughly clean surfaces until free from dirt, oil, and grease.
2. On galvanized surfaces, use solvent for the initial cleaning, then treat the surface thoroughly with phosphoric acid etch. Remove etching solution completely before proceeding.
3. Allow to dry thoroughly before application of paint.

D. Preparation of all new and noted existing plaster/drywall surfaces to receive paint:

1. All plaster and gypsum board shall have all loose existing paint removed. Thoroughly examine surfaces prior to and again after prime coat is applied. Joints and holes shall be properly filled, feathered out and sanded perfectly smooth to prevent detection of same through specified finish paint.

a. Do not apply finish coats until all unsatisfactory conditions have been corrected.

E. Preparation of all new and noted existing concrete block or concrete surfaces to receive paint:

1. Surfaces shall be thoroughly dry, free from dirt and dust; shall have mortar projections and splatters removed; shall have holes, cracks, and joints properly filled; mortar joints rubbed or stoned smooth; and surfaces otherwise properly prepared to receive the specified paint or special coatings.

a. If surfaces cannot be properly prepared, the conditions shall be reported to the General Contractor and Architect/Engineer.
b. Do not apply finish coats until all unsatisfactory conditions have been corrected.

3.4 PAINT APPLICATION

A. General:

1. Touchup shop-applied prime coats which have been damaged, and touchup bare areas prior to start of finish coats application.
2. Slightly vary the color of succeeding coats.

a. Do not apply additional coats until the completed coat has been inspected and approved.
b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.

3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.

B. Drying:

1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.
2. Consider oil-base and oleo-resinous solvent-type paint as dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Brush applications:

1. Brush out and work the brush coats onto the surface in an even film.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

D. Spray application:

1. Except as specifically otherwise approved by the engineer/architect, confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

E. Miscellaneous surfaces and procedures:

1. Exposed mechanical items:

a. Finish electric panels, access doors, conduits, outlet boxes, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed by the Engineer/Architect.
b. Wash metal with solvent, prime, and apply two coats of latex enamel.

3.5 PAINTING SCHEDULE

A. Provide the following paint finishes; Sherwin Williams as Basis of Design. Refer to 3.4.A.1 concerning specified prime coats.

B. Exterior and Interior (new and/or noted existing) unless noted otherwise:

1. All exposed plain iron and steel.

a. Includes but not limited to:

1) Handrails/Guards.
2) Hollow Metal Doors and Frames.
3) Exposed structural and miscellaneous steel, lintels, ladders

b. Finish System:

1) Sherwin Williams.

a) First/Prime Coat: DTM Acrylic Primer/Finish.
b) Second and Third Coat: Sher-Cryl HPA Semi-Gloss Enamel.

2) PPG Paints.
a) PPG Aquapon WB Epoxy Primer.
b) PPG Aquapon WB Acrylic Polyurethane.

3) Benjamin Moore.
a) Corotech Waterborne Acrylic Primer
b) Cototech Waterborne Acrylic Semi-Gloss Enamel

c. Exposed structural steel shall have shop prime coat touched up at welds, connections and abraided areas as necessary.

2. All exposed galvanized, aluminum, or copper metal.

a. Includes but not limited to:

1) Exposed galvanized mechanical piping and electrical conduit.

b. Finish System:

1) Sherwin Williams:

a) First/Prime Coat: DTM Acrylic Primer/Finish.
b) Second and Third Coat: Sher-Cryl HPA Semi-Gloss Enamel.

2) Sherwin Williams:

a) First/Prime Coat: DTM Acrylic Primer/Finish.
b) Second and Third Coat: Sher-Cryl HPA Semi-Gloss Enamel.

3) Benjamin Moore
a) Corotech Waterborne Acrylic Primer
b) Corotech Waterborne Acrylic Semi Gloss Enamel

3. Wood Surfaces, Trim, and Finish:

a. Includes but not limited to:
1) Standing and Running Wood Trim
2) Interior wood doors

b. Finish system shall consist of three coat paint system.
1) Sherwin Williams:
a) First/Prime Coat: ProMar 200 Interior Enamel Undercoater.
b) Second and Third Coats; ProMar 200 Interior Latex Semi-Gloss Enamel.
2) Benjamin Moore:

a) First/Prime Coat: Fresh Start Undercoater.
b) Ultra Spec 500 Interior Latex Semi-Gloss Enamel.
3) PPG:

a) First/Prime Coat: Seal Grip Interior.
b) Second and Third Coats: Speedhide Interior Latex Semi-Gloss Enamel.

4. Plaster and Gypsum Board areas:

a. Finish system:

1) Sherwin Williams:

a) First Coat: ProMar 200 Latex Wall Primer.
b) Second and Third Coats: ProMar 200 Interior Latex Eggshell Enamel.
2) Benjamin Moore:

a) First Coat: Ultra Spec 500 Interior Primer.
b) Second and Third Coats: Ultra Spec 500 Interior Latex Eggshell Enamel.
3) PPG:

a) First Coat: Speedhide Interior Primer.
b) Second and Third Coats: Speedhide Interior Latex Eggshell.

5. Concrete/Concrete Block areas:

    a. Finish system:

        1) Sherwin Williams:

            a) First Coat: PrepRite Block Filler.
            b) Second and Third Coats: ProMar 200 Interior Latex Eggshell Enamel.

        2) Benjamin Moore:

            a) First Coat: Ultra Spec Hi-Build Block Filler.
            b) Second and Third Coats: Ultra Spec 500 Interior Latex Eggshell.

        3) PPG:

            a) First Coat: Speedhide Latex Block Filler.
            b) Second and Third Coats: Speedhide Interior Latex Eggshell.

END OF SECTION 099100

SECTION 102818 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Toilet and bath accessories listed herein and shown on the drawings.

B. Rough-in frames furnished to other Sections.

C. Attachment hardware.

1.2 SUBMITTALS

A. Submit manufacturer's product data under provisions of Section 013300.

B. Data to illustrate each accessory at large scale and show installation method.

C. Submit manufacturer's installation instructions under provisions of Section 013300.

1.3 REFERENCES

A. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM A366 - Cold-Rolled Carbon Steel Sheets, Commercial Quality.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

1.5 PROTECTION

A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. McKinney/Parker.

B. Bobrick Washroom Equipment, Inc.

C. G. M. Ketcham Co., Inc.

D. American Specialties, Inc.

E. Bradley Corporation

2.2 MATERIALS

A. Sheet Steel: ASTM A366, cold rolled stretcher leveled; 125 oz/sq ft galvanized coating.

B. Stainless Steel Sheet: ASTM A167, commercial grade, 22 gage.

C. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.

D. Adhesive: Epoxy type contact cement.

E. Fasteners, Screws, and Bolts: Hot dip galvanized. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

A. Chrome/nickel Plating: Satin finish.

B. Stainless Steel: No. 4 stain luster finish.

C. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

D. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats baked enamel.

2.4 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces from one sheet of stock, free of joints.

C. Provide steel anchor plates and anchor components for installation on building finishes.

D. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

F. Hot dip galvanize ferrous metal anchors and fastening devices.

G. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and rough-in measurements as required.

B. Verify wood grounds are in place.

C. Before starting work notify Architect/Engineer in writing of any conflicts detrimental to installation or operation of units.

D. Verify with Architect/Engineer exact location of accessories.

3.2 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturer's instructions.

B. Install true, plumb, and level, securely and rigidly anchored to substrate.

C. Use tamper-proof fasteners.

3.3 SCHEDULE OF ACCESSORIES

A. Accessories of Bradley and Bobrick are listed as a standard quality. Equivalent products as approved by Architect are acceptable.

1. Cabin “A”, Room 101:

    a. 1 Mirror: 24” x 36”, B-165 2436.
    b. 1 Toilet Tissue Dispenser: 5241.
    c. 1 Shower Rod @ 36”: B6107 36.

2. Cabin “B”, Room 105:

    a. 1 Grab Bar (rear wall): 8122-001300.
    b. 2 Grab Bar (rear wall mount, swing-down): 837
    c. 1 Toilet Tissue Dispenser: B-7685.
    d. 1 Mirror: 24” x 36”, B-165 2436.
    e. 1 Shower Rod @ 60”: B6107 60.

END OF SECTION 102818

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers not located in cabinets.

1.2 SUBMITTALS

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

B. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals Operation" and maintenance data.

C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

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

    a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    b. Larsen's Manufacturing Company.
    c. Potter Roemer LLC.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type F.E.: UL-rated 4A-60BC, 10 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

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

a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
b. Larsen's Manufacturing Company.
c. Potter Roemer LLC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 107000 – PRE-CAST CONCRETE RESTROOM

PART 1 - GENERAL

1.1 SUMMARY

A. Owner to provide Cortez pre-cast concrete double flush toilet building and the Contractor will be required to coordinate delivery, foundation preparation and all utility connections for a complete and operable installation.

1.2 SUBMITTALS

A. The Owner shall Submit one (1) digital PDF set of submittal drawings to the contractor for reference.

B. Product Design Requirements:

1. See attached specifications.

C. Owner will coordinate all product submittal requirements and provide to the contractor for their information.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum of (10) years in the pre-cast construction industry.
2. Full time on-staff Licensed Engineer.
3. Full time on-staff Quality Assurance Manager.
4. Published Quality Management System.
5. Annual audit of Quality System and Plant Processes by Third Party Agency.

PART 2 - PRODUCTS

2.1 PRE-CAST SYSTEM AND MATERIALS

A. Manufacturers:

1. CXT Incorporated
   6701 E. Flamingo Avenue, Building 300
   Nampa, ID 83687
   Phone: 800.696.5766

2. Approved Equal

B. Product Requirements and Materials:

1. See attached specifications.

PART 3 - EXECUTION

3.1 ERECTION

A. Installation:

1. Install all components according to manufacturer's installation instructions.

END OF SECTION 107000

AMENDMENT TO SECTION 107000
PRECAST CONCRETE RESTROOM SPECIFICATIONS

1.0 SCOPE

This specification covers the construction and placing of the Cortez flush precast concrete toilet building as produced by CXT® Incorporated.

2.0 SPECIFICATIONS

ASTM C33	Concrete Aggregates
ASTM C39	Method of Test for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C143	Method of Test for Slump of Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, or Concrete
ASTM C192	Method of Making and Curing Test Specimens in the Laboratory
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bar for Concrete Reinforcement
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcine Natural Pozzolan for Use in Concrete
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 306	Cold Weather Concreting
ACI 318	Building Code Requirements Structural Concrete and Commentary (includes Errata)
PCI MNL 116	Quality Control for Plants and Production of Precast Prestressed Concrete Products

3.0 MANUFACTURER CRITERIA

The manufacturer supplying the requested precast concrete flush facility must meet the following:

A. Manufacturer must be ISO 9001 certified at the time of bid.

B. Manufacturing plant must be PCI certified at the time of bid.

C. Manufacturer must not have defaulted on any contract within the last five (5) years.

D. Manufacturer must provide stamped, engineered drawings prior to acceptance.

E. Manufacturer must be pre-approved prior to bidding.

F. Manufacturer must show four (4) examples of precast concrete flush facilities produced, installed and in use as an example of their ability to perform this contract.

G. Manufacturer (CXT) shall provide a one (1) year warranty on all concrete components. The warranty is valid only when concrete is used within the specified loadings. Furthermore, said warranty includes only the related material necessary for the construction and fabrication of said concrete components.

H. UL 752 Bullet Resistance on 4" thick concrete samples.

Manufacturer meeting these criteria is:

CXT Incorporated
6701 E. Flamingo Avenue, Building 300
Nampa, ID 83687
Phone 800-696-5766

4.0 DESIGN CRITERIA

The flush building has been designed to individually meet the following criteria. Calculations and engineer's stamped drawings are available, for standard buildings, upon request by the customer and are for their sole and specific use only. The design criteria are to ensure that the flush building not only will withstand the forces of nature listed below, but to provide protection from vandalism and other unforeseen hazards. Building's structural and foundation design will be relevant to the region and properties associated with its final placement. Design will also meet all applicable accessibility and building code requirements. Buildings will also meet various structural loads such as below, but not limited to/or restricted by them.

A. Roof Snow Load
   1. The flush building is designed to withstand a 250 PSF snow load.

B. Floor Load
   1. The flush building is designed to withstand 400 PSF floor load.

C. Wind Load
   1. The flush building will withstand the effects of 150 miles per hour (3-second gust) wind exposure C.

D. Earthquake
   1. The flush building will withstand the effects of a seismic group 1 design category E earthquake.

E. Additional Design Standards
   1. The flush building is designed to meet the accessibility requirements put forth by federal, state, and local statutes.
   2. The flush building is an all concrete design with a minimum 3/12 roof pitch. The flush building shall have a minimum 4" wall, 4½" roof, and 5" floor thickness.
   3. All wall to floor interior surface seams shall have a minimum 1" radius coving made of high strength grout.

+ Recycled Material
+ LED Lighting

MATERIALS

A. Concrete – General
   1. The concrete mix design is designed to ACI 211.1 to produce concrete of good workability.
   2. Concrete will contain a minimum of 675 pounds of cementitious material per yard. Cement is a low alkali type I/II or III conforming to ASTM C-150.
   3. Coarse aggregates used in the concrete mix design will conform to ASTM C33 with the designated size of coarse aggregate #67.
   4. Maximum water/cement ratio will not exceed .45.
   5. Air-entraining admixtures will conform to ASTM C260. Water reducing admixtures will conform to ASTM C494, Type A.
   6. If Self Compacting Concrete (SCC) is used, it must conform to ASTM C1611.

B. Concrete Reinforcement
   1. All reinforcing steel will conform to ASTM A615. All welded wire fabric will conform to ASTM A185.
   2. All reinforcement is new, free of dirt, oil, paint, grease, loose mill scale and loose or thick rust when placed.
   3. Details not shown on drawings or specified are to ACI318.
   4. Steel reinforcement is centered in the cross-sectional area of the walls and will have at least 1¼" of cover on the under surface of the floor.
   5. The maximum allowable variation for center-center spacing of reinforcing steel is ½".
   6. Full lengths of reinforcing steel are used when possible. When splices are necessary on long runs, splices are alternated from opposite sides of the components for adjacent steel bars.
   7. Lap bars under #4 a minimum of 12" bar diameters.
   8. Lap bars larger than #4 a minimum of 24" bar diameters.
   9. Reinforcing bars are bent cold. No bars partially embedded in concrete are field bent unless approved by the customer.

C. Caulking, Grout, Adhesive and Sealer
   1. Caulking service temperatures from -40ºF to +194ºF.
   2. Interior and exterior joints are caulked with a paintable polyurethane sealant.
   3. Grout is a non-shrink type and are painted to match the color of surrounding concrete as nearly as possible.
   4. Cement base coating is formulated with a very fine aggregate system and is a built-in bonding agent.

D. Paint
   1. All paints and materials will conform to all federal specifications or be similar "top-of-the-line-components."

2. Type of paints for toilets.
    a. Inside concrete surfaces.
        i. Interior floors will be a chemical resistant urethane. The color will be gray.
        ii. Interior walls and ceilings will be a modified acrylic, water repellent penetrating stain. The color will be white followed by a clear acrylic anti-graffiti sealer.
    b. Metal surfaces both inside and out.
        i. DTM ALKYD.
    c. Exterior concrete surfaces.
        i. Exterior slab will be clear sealer.
        ii. Exterior walls and roof will be a water repellent penetrating stain in the same color as the walls or roof followed by a clear acrylic anti-graffiti sealer.

E. Grab Bars
1. Grab bars will be 18-gauge, type 304 stainless steel with 1½" clearance. Grab bars will each be able to withstand 300-pound top loading.

F. Toilet Paper Dispenser
1. Dispenser will be constructed of ¼" thick, type 304 stainless steel. Dispenser will be capable of holding three (3) standard rolls of toilet paper. Toilet paper holder fastening system will be able to withstand 300-pound top loading.

G. Steel Doors
1. Doors will be flush panel type 1¾" thick, minimum 16-gauge galvanized steel, top painted with DTM ALKYD.
2. Door frames will be knockdown or welded type, single rabbet, minimum 16-gauge prime coated steel top painted with DTM ALKYD, width to suit wall thickness. Three (3) rubber door silencers will be provided on latch side of frame.

H. Door Hinges
1. Door hinges will be three (3) per door with dull chrome plating 4½" x 4½", adjustable tension, and automatic closing for each door.

I. Commercial Mortise Lockset
1. ANSI/BHMA certified Grade 1 mortise lockset for exterior door.
2. UL & ULC three-hour fire rating.
3. ANSI A-156 13-2005 certified.
4. ADA barrier free accessibility.
5. Deadbolt function included.
6. Thumb turn privacy function.

J. Doorstop
1. Doorstop will be a dome style stop meeting ANSI 156.16.

K. Double Coat Hook
1. Coat hook will be 304 stainless steel 16-gauge (1.5mm), formed construction with a satin finish and have $\frac{3}{16}$" x ⅞" nail in anchor. Upper hook will extend at least 2½" from the wall. Lower hook will extend at least 1¼" from the wall.

L. Door Sweep
   1. Door sweep will be provided at the bottom of door and will be an adjustable brush type.

M. Wall Vent
   1. Wall vent will be crank operated allowing the unit to be opened or closed. Crank will be removable. Vent cover will be 14-gauge 304 stainless steel and anchored into the concrete wall with high strength anti-rust tap con fasteners. Vent to come with insect screen. Cover to be recessed a minimum ¾" on exterior walls with a 45-degree bevel. Interior to be flush mounted. Wall vent will not protrude from the wall.

N. Signs
   1. Signs to have raised pictograms, letters, and braille to meet ADA.

O. Windows
   1. Window frames will be constructed from steel.
   2. Window glazing will be $\frac{3}{16}$" thick translucent pebble finished mar-resistant Lexan.
   3. Windows to have ¾" recess with 45-degree bevel.
   4. Window frames to have vandal resistant fasteners.

P. Mirrors
   1. Mirror to be 18" x 36" frameless 430 18-gauge stainless steel with #8 bright polish.

Q. Plumbing
   1. All fixtures to meet ANSI A112.19.2.
   2. Plumbing will be concealed in the service area.
   3. *Flush valve* – Concealed closet flush-o-meter constructed of rough brass. Furnish valve with integral vacuum breaker and wall mounted push button. Valve will be of a water saver type with a flow of 1.6 gallons per flush.
   4. *Hammer arrester* – Installed on water line.
   5. *Hose bib* – Available in the chase area.
   6. *Lavatory* – Vitreous china with back splashguard, front overflow opening, equipped with brass trap and drainpipe without stopper. Sink will be 20" wide x 18" front to back x 5¾" deep with ADA trap cover. Optional stainless steel fixtures available.
   7. Main shut-off valve and drain.
   8. *Toilet* – Constructed of vitreous china, wall hung, with siphon jet action. Toilet will have a back spud for a concealed flush valve connection and will be mounted with the top of the seat 18" above the finished floor. Seat will be heavy duty solid plastic with an open front. Optional stainless steel fixtures available.
   9. Trap primer distribution unit.
   10. *Waste and vent material* – ABS or PVC plastic and will be plumbed to meet Uniform Building Codes.
   11. *Water material* – Copper tubing Type L, hard drawn. A gate valve will be provided at the inlet end of the water line. All water lines will be of a size to provide proper flushing action based on a nominal water pressure of 40 psi.
   12. *Water valve* – Self-closing water set with indexed push button.

13. *Water heater* – High efficiency commercial grade water heater(s) provided per code.

R. Electrical
   1. All components are UL listed.
   2. *Breaker panel* – 100 amps, mounted to meet electrical code.
   3. *Interior lighting* – Vandal resistant fixtures with built-in occupancy sensor, energy efficient LED lights, and lifetime warranty.
   4. *Exterior lighting* – Vandal resistant fixtures with built-in photoelectric switch, energy efficient LED lights.
   5. *Exhaust fans* – All wet location motion activated with speed control in chase area to control CFM.
   6. *Wiring* – Conduit, surface mounted in the service area and concealed in the user compartments. All wire will be copper.
   7. Optional warm air, ADA compliant, vandal resistant hand dryers available.

5.0 MANUFACTURE

A. Finishing Concrete
   1. All exterior building walls and exterior screen walls will be any one of the available textures.
   2. All exterior surfaces of the roof panels will be cast to simulate any one of the available textures. The underside of the overhang will have a smooth finish.

B. Cracks and Patching
   1. Cracks in concrete components which are judged to affect the structural integrity of the building will be rejected.
   2. Small holes, depressions, and air voids will be patched with a suitable material. The patch will match the finish and texture of the surrounding surface.
   3. Patching will not be allowed on defective areas if the structural integrity of the building is affected.

6.0 FINISHING AND FABRICATION

A. Structural Joints
   1. Wall components will be joined together with two (2) welded plate pairs at each joint. Each weld plate will be 6″ long and located one (1) pair in the top quarter and one (1) pair in the bottom quarter of the seam. Weld plates will be anchored into the concrete panel and welded together with a continuous weld.
   2. The inside seams will be a paintable caulk. The outside seams will use a caulk in a coordinating building color or clear.
   3. Walls and roof will be joined with weld plates, 3" x 6" at each building corner.
   4. The joint between the floor slab and walls will be joined with a grout mixture on the inside, a matching colored caulk on the outside and two (2) weld plates 6″ long per wall.

B. Painting/Staining
   1. An appropriate curing time will be allowed before paint is applied to concrete.

2. Schedule of finishes.
    a. Inside concrete surfaces.
        i. Inside floors will be one (1) coat of 1-part water based chemical resistant urethane.
        ii. Interior walls and ceilings will be two (2) coats of a modified acrylic, water repellent penetrating stain, followed by one (1) coat of clear sealer.
    b. Metal surfaces both inside and out.
        i. Two (2) coats of DTM ALKYD.
    c. Exterior concrete surfaces.
        i. Exterior walls will be two (2) coats of water repellent penetrating stain in the same color as the walls or roof followed by one (1) coat of clear acrylic anti-graffiti sealer.

7.0 TESTING

The following tests will be performed on concrete used in the manufacture of toilets. All testing will be performed in the CXT (PCI certified) laboratories. Testing will only be performed by qualified individuals who have been certified ACI Technician Grade 1. Sampling will be in accordance with ASTM C172.

A. The air content of the concrete will be checked per ASTM C231 on the first batch of concrete. The air content will be in the range of 5.0% +/- 2.0%.

B. The compressive strength of the cylinders will be tested to ASTM C39. We will make one (1) cylinder for release, one (1) for seven (7) days and one (1) for 28 days. The release must be a minimum strength of 2500 psi, the 7-day must be a minimum of 4500 psi and the 28-day must be a minimum of 5000 psi.

C. A copy of all test reports will be available to the customer as soon as 28-day test results are available.

8.0 INSTALLATION

A. Scope of Work
    1. Work specified under this section relates to the placement of the unit by CXT on customer prepared foundations. *See Installation Specifications or by others.*

B. Location
    1. It is the responsibility of the customer to:
        a. Provide exact location by stakes or other approved method.
        b. Provide clear and level site free of overhead and/or underground obstructions. *See Installation Questionnaire for details.*
        c. Provide access to the site for truck delivery and sufficient area for the crane to install and the equipment to perform the contract requirements. *See Installation Questionnaire for details.*
        d. Water, electrical, and sewage site connections to be placed per CXT drawings. Must be placed to easily connect to the building. *See Installation Questionnaire for details.*

C. Compacting
    1. The bottom of the area must be compacted after it has been dug out. After the base has been placed, it must be compacted as well. The bearing of the soil and base should be a minimum of 1,500 pounds per square foot.

D. Base
   1. After compacting the bottom of the area, a minimum of 6" thick and consist of ¾" minus crushed rock (i.e. road base material) compacted to 95% of optimal density in accordance with ASTM D1557. Finished surface of sub-base shall be flat and level, with a maximum deviation of -½", +0" from a true horizontal plane.
   2. The base should be placed for support, leveling and drainage purposes, and also to limit frost action. The base must be confined so as to prevent washout, erosion, or any other undermining.

E. Access to Site
   1. Delivery to site made on normal highway trucks and trailers. If at the time of delivery conditions of access are hazardous or unsuitable for truck and equipment due to weather, physical constraints, roadway width or grade, CXT may require an alternate site with better access provided to ensure a safe and quality installation. In any such case, additional costs for cranes, trucking, etc. will be charged to the account of the customer. *See Installation Questionnaire for details*.

9.0 WARRANTY—PRECAST DIVISION

CXT provides a one (1) year warranty. CXT warrants that all goods sold pursuant hereto will, when delivered, conform to specifications set forth above. Goods shall be deemed accepted and meeting specifications unless notice identifying the nature of any non-conformity is provided to CXT in writing within the specified warranty. CXT, at its option, will repair or replace the goods or issue credit for the customer provided CXT is first given the opportunity to inspect such goods. It is specifically understood that CXT's obligation hereunder is for credit, repair, or replacement only, F.O.B. CXT's manufacturing plants, and does not include shipping, handling, installation or other incidental or consequential costs unless otherwise agreed to in writing by CXT.

This warranty shall not apply to:

1. Any goods which have been repaired or altered without CXT's express written consent, in such a way as in the reasonable judgment of CXT, to adversely affect the stability or reliability thereof;
2. To any goods which have been subject to misuse, negligence, acts of God or accidents; or
3. To any goods which have not been installed to manufacturer's specifications and guidelines, improperly maintained, or used outside of the specifications for which such goods were designed.

10.0 DISCLAIMER OF OTHER WARRANTIES

The warranty set forth above is in lieu of all other warranties, express or implied. All other warranties are hereby disclaimed. CXT makes no other warranty, express or implied, including, without limitation, no warranty of merchantability of fitness for a particular purpose or use.

11.0 LIMITATION OF REMEDIES

In the event of any breach of any obligation hereunder, breach of any warranty regarding the goods or any negligent act or omission or any party, the parties shall otherwise have all rights and remedies available at law; however, IN NO EVENT SHALL CXT BE SUBJECT TO OR LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Kitchen cabinets.
2. Vanity cabinets.
3. Plastic-laminate countertops with integrated backsplashes.

1.2 SUBMITTALS

A. Product Data: For cabinets, countertop material, and cabinet hardware.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

1.3 QUALITY ASSURANCE

A. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.

a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location.

2. Plastic-Laminate Countertops: KCMA A161.2.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. General:

1. Certified Wood Materials: Provide cabinets made from wood and wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."
2. Adhesives: Do not use adhesives that contain urea formaldehyde.
3. Hardwood Lumber: Kiln dried to 7 percent moisture content.
4. Softwood Lumber: Kiln dried to 10 percent moisture content.
5. Hardwood Plywood: HPVA HP-1, made without urea formaldehyde.
6. Particleboard: ANSI A208.1, Grade M-2, made without urea formaldehyde.
7. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made without urea formaldehyde.

8. Hardboard: AHA A135.4, Class 1 Tempered.

B. Exposed Materials:

1. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

a. Colors, Textures, and Patterns**:** As selected by Architect from cabinet manufacturer's full range.

C. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.2 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Wire pulls.

C. Hinges: Concealed European-style self-closing hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

2.3 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Grade: HGS.
2. Colors, Textures, and Patterns: As selected by Architect from countertop manufacturer's full range.

B. Certified Wood Materials: Provide countertops made from wood and wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

C. Particleboard: ANSI A208.1, Grade M-2.

2.4 CABINETS

A. Available Products: Subject to compliance with requirements, cabinets that may be incorporated into the Work include, but are not limited to, the following:

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

1. Schrock Cabinets
2. Bertch Cabinets
3. KraftMaid Cabinets
4. Equivalent product as approved by Architect.

C. Face Style: Flush overlay.

D. Cabinet Style: Face Frame.

E. Door and Drawer Fronts: 5/8 inch thick plastic-laminate-faced plywood, with continuous with PVC edge banding.

F. Face Frames: 5/8 inch thick plywood with plastic laminate on exposed and semiexposed surfaces.

G. Exposed Cabinet End Finish: Plastic laminate panels.

2.5 PLASTIC-LAMINATE COUNTERTOPS

A. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:

1. Front: Rolled (as indicate on drawings).
2. Backsplash: Curved or waterfall shape.
3. Endsplash: None.

2.6 BATHROOM VANITY UNIT

A. For Cabin Type “A” and Cabin Type “B”, provide same ADA-compliant vanity unit with sink and faucet included, with dimensions as indicated in the drawings.

B. Products:

1. Basis of Design to be Goodtime Medical Cabinets ADA Vanity.
2. Equivalent product as approved by architect.

C. Exposed Materials:

1. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of ⅛ inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.

F. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

G. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

END OF SECTION 123530

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. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.

1.2 SUBMITTALS

1. Not Used.

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, crawlspaces, 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
b. Local plumbing code
c. National Fuel Gas Code, latest edition

B. Contractor shall obtain all necessary permits and arrange for all inspections required by State or Local authorities.

C. 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.

D. 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 not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

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.

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.

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 if 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. Identification:

1. Every piece of equipment, disconnect, etc. which does not have and identifying name plate shall be stenciled to identify its use, by means of the abbreviations used in these specifications. Stencil shall be painted in approved colors, with letters at least ¼" high. Stencil shall be located as approved by the Engineer/Architect. At contractor's option, tags may be riveted or screwed to equipment, in place of stencils.

C. 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.

    a. 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.

D. Permits, Fees, Enlargements, Extensions, Etc.:

1. Contractor shall secure and pay for all licenses, assessments, permits; shall pay for inspections required by county, state, and local utilities; and shall replace new or present paving etc. as approved by Engineer/Architect and all governmental bodies having jurisdiction. All without increase in contract price.

E. Verification of Points of Connection:

1. Before submitting his bid, contractor shall visit site to verify all exposed, concealed, and buried points of connection as to locations, flow, size, type, depth, pressure, elevation, operating characteristics, etc., including but not limited to the following:

    a. Water service and shut-offs.
    b. Sanitary sewer connections.
    c. Storm sewer connections.

2. If contractor finds that any present point or points of connection to existing facilities are incorrectly shown on plans or incorrectly specified, he (she) shall notify Engineer/Architect in writing at least 7 days before bids are due to be submitted. Engineer/Architect will issue as addendum to all contractors, calling their attention to revised point or points of connection.
3. If contractor fails to notify Engineer/Architect in writing as outlined above, it will be assumed that his bid includes everything required to provide proper connections to all present points of connections as they actually exist and will pay for all relocations, replacements, additional runs and extensions, 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. Verify final equipment locations for roughing-in.

O. 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. 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.

F. 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. 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.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.
5. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

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. 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 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.

3.7 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 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

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

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.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 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.

2.3 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.

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 non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
3. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
4. 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.
5. 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-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
7. 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. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

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. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. 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”

E. 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.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel.

H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. 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.

J. 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. 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.

4. Insert Material: Length at least as long as protective shield.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.4 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. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. 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.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

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

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 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 and Storm Drainage Piping:

    a. Background Color: White.
    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.
b. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Tapes.
8. Securements.

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.

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.

G. Mineral-Fiber, Preformed Pipe Insulation:

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

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000 Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

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

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 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.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

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.

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

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.

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

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

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

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

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.7 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

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

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire.
   b. Childers Products.
   c. PABCO Metals Corporation.
   d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water.

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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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 attachments 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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 pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

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. 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 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. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 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.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Cold Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 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.

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.
5. Copper Pressure-Seal-Joint Fittings:

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

        1) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 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.

2.5 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

2.6 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.

2.7 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.

2.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance

2.9 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.

2.10 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.

2.11 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.

2.12 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

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Strainers.
2. Wall hydrants.
3. Drain valves.
4. Water hammer arresters.

1.2 SUBMITTALS

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

B. 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 WALL HYDRANTS

A. Non-freeze 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. Watts Drainage Products Inc.
c. Woodford Manufacturing Company.
d. Zurn Plumbing Products Group; Light Commercial Operation.

2.2 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.

2.3 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. Sioux Chief Manufacturing Company, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Watts Drainage Products Inc.
   g. 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 water hammer arresters in water piping according to PDI-WH 201.

C. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

END OF SECTION 221119

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.

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. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. 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 Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. 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.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Section 220500 "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. 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."

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. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

I. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

J. 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 Section 220523 "General-Duty Valves for Plumbing Piping."

B. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

C. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Section 220529 "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 Section 220529 "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. 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.

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 Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection.

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

SECTION 221319 - SANITARY WASTE AND VENT PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

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. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: As required to match connected piping.
5. Closure: Raised heat 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. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. 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 caulk.
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.

C. Wall 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. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: as required to match connected piping.
5. Closure: Countersunk or raised head plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat chrome plated bronze cover plate with screw.
8. Wall Access: Round wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the 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. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. 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 VENT FLASHING ASSEMBLIES

A. Roof Vent 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. Thaler Metal Industries Ltd.

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 220500 "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.

I. Install deep-seal traps on floor drains and other waste outlets.

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 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

SECTION 223500 - DOMESTIC WATER HEATERS

1.1 SUMMARY

A. This Section includes the following:

1. Instantaneous water heaters.
2. Water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type and size of heat exchanger indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Operation and maintenance data.

C. 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. 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 heat exchangers 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): From date of Substantial Completion:

a. Instantaneous Heat Exchangers: 5 year(s).

PART 2 - PRODUCTS

2.1 INSTANTANEOUS WATER HEATERS

A. Instantaneous Water Heaters:

1. Available Manufacturers:

    a. American Water Heaters.
    b. Navien.
    c. A.O. Smith Water Heaters.
    d. Rinnai.

2. Description: On demand electric tankless water heaters.
3. Setpoint temperature: 120°F
4. Safety Control: Automatic, high-temperature-limit cutoff device or system.
5. Miscellaneous Components: Strainers, steam-control valve, steam trap, valves, and piping.
6. Mounting: Provide accessories as necessary for wall mount installation.
7. Capacity and Characteristics:

    a. Refer to equipment schedule on the project plans.

2.2 WATER HEATER ACCESSORIES

A. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than working-pressure rating of heat exchanger.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

PART 3 - EXECUTION

3.1 HEAT-EXCHANGER INSTALLATION

A. Install heat exchangers 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.

B. Anchor heat exchangers to substrate.

C. Install combination temperature and pressure relief valves in water piping for heat exchangers without storage. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install heat-exchanger 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 heat exchangers that do not have tank drains.

E. Install thermometer on each water heater outlet piping.

3.2 CONNECTIONS

A. Install piping adjacent to heat exchangers to allow service and maintenance. Arrange piping for easy removal of heat exchangers.

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. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections and prepare test reports:

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.

C. Remove and replace heat exchangers that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 223500

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUBMITTALS

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

B. Operation and maintenance data.

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. Basis of Design:

1. Provide product make and model listed in plumbing schedule on sheet P501. Equivalent products may be provided from the other manufacturers listed in the plumbing schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

C. Install wall-mounting fixtures with tubular waste piping attached to supports.

D. Install fixtures level and plumb according to roughing-in drawings.

E. 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.

F. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

G. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

H. Install toilet seats on water closets.

I. 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.

J. 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.

K. Install traps on fixture outlets:

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

L. 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."

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

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. Dielectric fittings.
3. Escutcheons.

1.2 REFERENCES

A. Standards:

1. ASME American Society of Mechanical Engineers.
2. UL Underwriters Laboratories, Inc.
3. ANSI American National Standard Institute.

1.3 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, crawlspaces, 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.

1.4 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. Electrical Characteristics for HVAC 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.

1.5 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.

1.6 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.

1.7 WARRANTY

A. Contractors and manufacturers warranty shall be 1 year after substantial completion.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 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 23 piping Sections for special joining materials not listed below.

B. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

2.3 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 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 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 penetrations of walls, ceilings, and floors.

M. Where pipe passes through building walls and floors cuts shall be square or round and ground smooth.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 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. 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.

3.3 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 HVAC 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.

3.4 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

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.

B. Related Sections:
1. Division 23 Section 233113 "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 size and location of supports, hangers, and insulation shields specified in Division 23 Section 220529 "Hangers and Supports for HVAC Piping and Equipment."

B. 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. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. 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.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. 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.

F. 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.

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: White.

2.4 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.5 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. 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.

2.6 TAPES

A. ASJ Tape: White 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.

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.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. 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.

B. Insulation Installation at Interior Wall and Partition Penetrations: Install insulation continuously through walls and partitions.

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 insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round duct elbows with individually mitered gores cut to fit the elbow.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.8 INDOOR DUCT INSULATION SCHEDULE

A. Concealed, Supply Air, rectangular and round, duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2-1/8 inches thick and 0.75-lb/cu. ft. nominal density.

3.9 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.

3.10 PIPING INSULATION SCHEDULE

A. Refrigerant Suction, Liquid, and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

3.11 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. Aluminum jacket.

END OF SECTION 230700

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 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: 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. Delegated-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.
5. Design Calculations: Calculations for selecting 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.

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. Where ducts pass through 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.

J. 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. 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.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. 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 interval of 16 feet.

E. 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

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible ducts.

1.2 SUBMITTALS

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

1.3 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 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.

2.4 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.

2.5 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.

2.6 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.

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 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.

C. Set dampers to fully open position before testing, adjusting, and balancing.

D. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At maximum 50-foot spacing.
2. Upstream of turning vanes.
3. Elsewhere as indicated.

E. Install access doors with swing against duct static pressure.

F. 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.

G. Connect diffusers to low-pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

H. 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.

B. Related Sections include the following:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to 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.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

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. Krueger HVAC.
2. Nailor Industries of Texas Inc.
3. Price Industries.
4. 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 235400 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Air-to-air heat pump air handling units complete with controls.
2. Air filters.
3. Air cleaners.
4. Refrigeration components.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:

1. Air handling unit.
2. Thermostat.
3. Air filter.
4. Refrigeration components.

B. Operation and Maintenance Data.

C. 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. 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:

1. Mitsubishi
2. Daikin.
3. Amana Heating & Air Conditioning; Goodman Manufacturing Company, L.P.
4. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
5. Carrier Corporation; Div. of United Technologies Corp.
6. Comfort-Aire; a division of Heat Controller, Inc.

7. Lennox Industries Inc.
8. Rheem Manufacturing Company; Air Conditioning Division.
9. Ruud Air Conditioning Division.
10. York International Corp.; a division of Unitary Products Group.

B. General Requirements for air handling units: Factory assembled, piped, wired, and tested.

C. Cabinet: Steel, with duct liner.

1. Duct Liner: Fiberglass, minimum 1/2 inch thick, complying with ASTM C 1071 and having a coated surface exposed to airstream complying with NFPA 90A or NFPA 90B and with NAIMA's "Fibrous Glass Duct Liner Standard."
2. Factory paint external cabinets in manufacturer's standard color.

D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
1. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated air handling unit/blower control.

E. Electric-Resistant Heating Elements: Helix-wound, nickel-chromium wire-heating elements in ceramic insulators mounted on steel supports.

1. Heating element capacity: 3KW.

F. Heating-Element Control: Sequencer relay with relay for each element; switches elements on and off, with delay between each increment; initiates, stops, or changes fan speed.

2.2 THERMOSTATS

A. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.

B. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.

2.3 AIR FILTERS

A. Disposable Filters: 1-inch thick, disposable type in sheet metal frame.

2.4 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
2. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Standard for Buildings except Low-Rise Residential Buildings."

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with air handling unit. Include condensate drain pan with accessible drain outlet.

1. Refrigerant Coil Enclosure: Steel, matching air handling unit and evaporator coil, with access panel and flanges for integral mounting at or on air handling unit cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1/2 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide bottom return air plenum. Plenum shall support the weight of the air handling unit, filter rack, and vertical supply air ductwork.

B. Controls: Install thermostats at mounting height of 48 inches above floor.

C. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Connect refrigerant tubing kits to refrigerant coil in air handling unit and to air-to-air heat pump unit:

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
2. 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.

C. Complete installation and startup checks and start units according to manufacturer's written instructions.

D. Verify proper operation of capacity control device.

E. Adjust airflow and initial temperature set points.

F. After completing installation, clean air handling units internally according to manufacturer's written instructions.

G. Install new filters in each air handling unit within 14 days after Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235400

SECTION 238126 – AIR-TO-AIR HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and Maintenance Data: For split-system heat pump units to include in emergency, operation, and maintenance manuals.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system heat pump units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR-TO-AIR HEAT PUMPS

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. Mitsubishi Electronics America, Inc.; HVAC Division.
3. Sanyo Fisher (U.S.A.) Corp.
4. Samsung

B. Cooling Capacity at 95°F Outdoor Air Temperature: As noted in the cooling capacity column of the heat pump schedule on the project plans.

C. Heating Capacity at -13°F Outdoor Air Temperature: As noted in the heating capacity column of the heat pump schedule on the project plans.

D. Accessories:

1. Wall mount hardware and install at 4’-0” above finished grade.

2. Drain pan heater.
3. Wind baffles.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit.

D. Install roof-mounting compressor-condenser components on equipment supports.

E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

F. Install piping adjacent to unit to allow service and maintenance.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.2 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor for this work is referred to the Drawings, Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work which is a part of this Contract. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.

1.3 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. 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. Submit all changes, other than minor adjustments, to the Engineer/Architect for approval before proceeding with the work.

F. 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.

G. 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.

H. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. To ensure connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.

I. Coordinate installation of electrical boxes that are recessed in pre cast wall with precast wall manufacturer. This may require that the electrician be present at the precast wall manufacturer location during the forming of the panels. All costs associated with this coordination shall be included within the bid and no additional time or charges will be allowed to facilitate this coordination.

J. All field holes in precast wall assemblies shall be core drilled holes made in accordance with precast wall manufacturer directions.

K. All buried conduits passing from below the proposed building to the exterior shall pass below the proposed structural footing.

L. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

M. Coordinate sleeve selection and application with selection and application of firestopping.

N. Where thermostat locations are shown, the electrical contractor shall provide a recessed wall box with conduit to an accessible location. In areas where surface mounted boxes are required, a surface mounted box and conduit to 10’ AFF shall be provided (or to the equipment location, whichever is closer). Thermostat installation and the corresponding low voltage thermostat wiring shall be by the mechanical contractor.

1.4 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.

1.5 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.

1.6 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 EQUIPMENT SELECTION AND APPROVAL

A. The selection of materials and equipment to be furnished shall be governed by the following:

1. Where trade names, brands of manufacturer of equipment or materials are listed in the specification, the exact equipment listed shall be used in the bid or the contractor shall submit the necessary literature to show the alternative product meets the performance characteristics of that which has been called for. Where more than one name is listed, Contractor may select any one of the various brands specified.

2.3 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. 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

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 and XHHW: 90°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.

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 (Type MC) cable limited to six feet in length.

E. Existing walls and ceilings requiring fishing of cable between access points: Metal clad cable (Type MC).

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

G. 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. Install and make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor at each splice, tap conductor and equipment termination for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL 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 methods and materials for grounding systems and equipment.

B. Grounding system shall be in compliance with all requirements of the National Electrical Code.

1.3 SUBMITTALS

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

B. Field Quality Report

1. Photo Report
2. Dimensioned as-built locations of grounding features

1.4 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.

2.2 BONDING TERMINATIONS

A. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

B. Intersystem Bonding Termination:

1. Lay-in connection clamp sized for connected grounding electrode conductor
2. Minimum of (5) bonding conductor terminals (#14 AWG- #4 AWG)
3. UV stabilized base and housing with stainless steel mounting hardware
4. UL listed as an intersystem bonding termination

2.3 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.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 inch in diameter by 10 feet or as noted on the Drawings.

B. Segmented Ground Rods: Copper-clad steel; 5/8 inch in diameter by 8 feet in length, capable of being threaded together to form a continuous vertical grounding electrode 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 mechanical rooms.

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. Connections to Ground Rods: Bolted 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. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

G. 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.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

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.

2. *Segmented Ground Rods: Use manufacturer approved ground rod driving methods and equipment to ensure connecting threads on multiple segmented grounds are not damaged.*

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.

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.

3.4 FIELD QUALITY CONTROL

A. Provide a photo report consisting of labeled pictures of all of the following grounding features:

1. Ground rods
2. Intersystem bonding termination
3. Grounding connection to rebar in footing/floor
4. Grounding connection to metallic water pipe

B. Dimensioned as-built plans showing the locations of the key grounding features contained in the photo report shall be submitted concurrently with the photo report.

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. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
3. Toggle Bolts: All-steel springhead type.
4. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as 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.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. 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.

3.3 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

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL 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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 SUBMITTALS

A. Product data.

1.4 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. PVC Coated Rigid Steel Conduit: UL 6, NEMA RN 1

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all types and flexible and liquid-tight), 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.

G. 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°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. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. 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: Non-skid 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 water stop, 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: PVC coated Rigid Steel Conduit.
2. Concealed Conduit: EMT.
3. Underground Conduit: Schedule 40 PVC, direct buried.
4. Connection to Vibrating 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: 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. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

H. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

I. 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.

J. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

K. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
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.

L. Raceways below slabs:

1. Minimum conduit size shall be 1".
2. Change from PVC conduit to rigid steel conduit before rising above floor.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

N. 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.

O. 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. Separate lengths with pull/junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

P. 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.

Q. Covers for all junction boxes containing emergency circuits shall be red and labeled according to "260553 Identification for Electrical Systems."

R. 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.

S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

1. Wall boxes in tile, marble, brick or other finished masonry wall shall be of welded construction and designed for installation within masonry.

T. Set metal floor boxes level and flush with finished floor surface.

U. Metal boxes cast in concrete shall be designed for concrete installation.

V. Weather-proof boxes shall be die cast aluminum.

W. Boxes for exposed work in finished area to be Type FS with threaded hubs and rigid conduit risers.

X. Install expansion fittings at all locations where conduits cross building expansion joints.

Y. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.

Z. 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.

AA. 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 as needed 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 (minimum) 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. Buried Warning Identification Tape: Provide 6 wide plastic detectable tape with foil backing 12 inches minimum below grade, and 12 inches minimum above conduits.

3.4 ELECTRICAL MANHOLES

A. Provide 3/4 inch x 10 feet in length ground rod through bottom of manhole in location coordinated with manufacturer.

B. Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C 857 and ASTM C 478M. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable installed.

C. Precast Concrete Structures, Risers and Tops

1. In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

D. Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 30 MPa. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

E. Obtain on-site soil information for manufacturer precast design.

F. Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

G. Cable Racks

1. Provide wall bracket as indicated on the drawings. Apply zinc coating after fabrication.
2. Cable rack arms shall be steel or malleable iron or glass reinforced nylon and shall be of the removable type. Rack arm length shall be a minimum of 8 inches and a maximum of 12 inches.

H. Pulling-In Irons

1. Provide steel bars cast in the walls/floors and bent as indicated. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices shall be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons shall be a minimum of 6 inches from the edge of the sump, and in the walls the irons shall be located within 150 mm of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron shall not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inches clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 36-inch long piece of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner shall be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons shall have a clear projection into the structure of approximately 4 inches and shall be designed to withstand a minimum pulling-in load of 6,000 pounds. Irons shall be hot-dipped galvanized after fabrication.

3.5 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.

D. CABLE TAGS IN MANHOLES & HANDHOLES

1. Provide tags identifying, the origin and destination, for each cable located in each manhole. The tags shall be polyethylene.Do not provide handwritten letters.

2. Polyethylene Cable Tags:

   Provide tags of polyethylene that have an average tensile strength of 22.4 MPa and that are two millimeter, non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C. Provide 1.3 mm thick black polyethylene tag holder.

   Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 778.75 N. The cable tags shall have black block letters, numbers, and symbols 25 mm high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

3.6 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. Interior Penetrations: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.

I. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

J. 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

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL 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:

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.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR, 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 under clear label 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. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Color Scheme

1. Emergency Warning labels: White background with red letters
2. All other warning labels: Yellow background with black letters

D. 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. Service Equipment emergency sources warning: “CAUTION – TWO SOURCES OF SUPPLY- EMERGENCY POWER SOURCE LOCATED IN GENERATOR ROOM 207 ON NORTH SIDE OF BUILDING.”

4. Generator Warning Label: “EMERGENCY GENERATOR”

5. Automatic Transfer Switch Warning Label: “EMERGENCY TRANSFER SWITCH”

6. Emergency Panel Warning Label: “EMERGENCY PANEL”

7. Junction boxes containing emergency circuits: “EMERGENCY CIRCUITS- PANEL *insert name”*

8. 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, lighting, communication, and control wiring and optical fiber cable. 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. Electrical switchgear and switchboards.
c. Transformers.
d. Generators
e. Disconnect switches.
f. Power transfer equipment.
g. Contactors.
h. Timeclocks
i. Fire alarm control panel and annunciators
j. 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. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. 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

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 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. Retain first subparagraph below if series rating of overcurrent protective devices is used.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 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.

1.5 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.
    c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    e. Or as noted on the plans

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: Provide typewritten circuit 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 LIGHTING AND APPLIANCE BRANCH-CIRCUIT 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, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or main lugs only as noted on Drawings

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 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. AFCI Circuit Breakers: Single pole configurations for 15A and 20A circuits per NFPA 70 Article. 210.12.

4. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. 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.

C. 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.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Recessed panels: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

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 complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches.

1.3 SUBMITTALS

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

1.4 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:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 5351 (single), CR5362 (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:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; TRBR20.
    b. Hubbell; BR20TR.
    c. Leviton; TCR20

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

    a. Cooper; GF20.
    b. Pass & Seymour; 2084.
    c. Hubbell; GF20

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:

    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. Double-throw, Center-Off Switches (3-Position): 120/277 V, 20 A, HP Rating 1HP- 120V, 2HP-277V

D. Key-Operated Switches, 120/277 V, 20 A:

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: Steel with white baked enamel, suitable for field painting
3. Material for Unfinished Spaces: Galvanized steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 RECEPTACLE APPLICATION

A. In all areas accessible to students: Tamper Resistant receptacles

B. In areas not accessible to students: Standard receptacles

C. Where required by the most recent version of the NEC and as indicated on the plan sheets: GFCI 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 ensure 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. Pigtailing 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, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.3 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. 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

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 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.

1.4 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.

1.5 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 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

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, 208/120V Type Heavy Duty three pole, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks interlocked with cover in closed position.

C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, 208/120V Type Heavy Duty three pole lockable handle with capability to accept two padlocks 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.

2.3 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. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

C. 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

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures.
2. Lighting fixture supports.

1.3 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. Energy-efficiency data.
3. Life, output, and energy-efficiency data for lamps.

1.4 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.

1.5 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 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. Support 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.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires.
2. Poles and accessories.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of installation and construction.
3. Luminaire materials.
4. Lamps, including life, output, and energy-efficiency data.
5. Materials, dimensions, and finishes of poles.
6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
7. Anchor bolts for poles.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See lighting schedule on Drawings.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Exposed Hardware Material: Stainless steel.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

I. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

B. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet .
3. Trees: 15 feet.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
2. Install base covers, unless otherwise indicated.
3. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole, unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

END OF SECTION 265600

SECTION 311600 - SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing plants and grass to remain
2. Removing and disposing of existing trees, shrubs, plants, and grasses
3. Clearing and grubbing
4. Stripping and stockpiling topsoil
5. Removing and disposing of above and below grade site structures and appurtenances
6. Removing and disposing of pavements and sidewalks
7. Disconnecting and capping or sealing site utilities
8. Temporary traffic control measures
9. Salvaging of specified materials for the Owner

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 incorporated into the Project site.

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: The Contractor shall be responsible for the locating all public and State-owned utilities. This shall be through the notification of a utility locator service such as Missouri One Call or a private locator service for the entire project area before site clearing.

D. Do not commence site clearing operations until Erosion Control Measures and any required Storm Water Pollution Prevention Plans (SWPPP) provisions are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 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. Provide to the Owner digital photography of existing site conditions prior to start of work including pavements to remain and which will be used during construction.

D. 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 and applicable permanent erosion and sedimentation control measures to per Section 312513 “Erosion Control” and the Storm Water Pollution Protection Plan (SWPPP), including but not limited to prevention of soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, streets and walkways.

B. Inspect, repair, and maintain and remove erosion and sedimentation control measures during construction until permanent vegetation has been established per the SWPPP.

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.

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 not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's/Architect's written permission.

C. Utilities by Others: Coordinate with others installing utilities on site or relocating and adjusting utilities offsite for the project. Schedule and arrange for necessary tie-ins and connections.

3.5 CLEARING AND GRUBBING

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. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

C. Tree removal:

1. November 1 through March 31: No restrictions on tree cutting.
2. April 1 through October 31: Cut trees only after authorized by the Engineer/Owner and upon receiving a copy of the Determination of Effect indicating no affect to threatened or endangered species is expected within the work area.
3. Also, if tree removal is completed between April 1 and October 31, the contractor will be required to contact the Missouri State Parks to complete the bat surveys of the affected area.
4. Cut off trees and stumps at the existing ground level. Remove stumps and roots as needed.
5. Remove trees and stumps within 2 feet of the proposed structures and underground piping to a depth of not less than 12 inches below the base elevation of proposed structures or underground piping.

D. 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 and stockpile topsoil materials per Section 312300 “Excavation and Fill”.

3.7 SITE IMPROVEMENTS

A. Remove existing above and below grade structures, foundations, pavements and 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 Owner's property.

B. Any timber and or brush that is ground into mulch can be used on site as directed by the owner.

C. Do not burn debris at the site.

D. Do not conduct any generation, transportation, or recycling of construction or demolition debris, clean or general or uncontaminated soil generated during construction, remodeling, repair, and demolition of utilities, structures, and roads that is not commingled with any waste, without the maintenance of documentation identifying the hauler, generator, place of origin of the debris or soil, the weight or volume of the debris or soil, and the location, owner, and operator of the facility where the debris or soil was transferred, disposed, recycled or treated. Maintain documentation for three years.

END OF SECTION 311600

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 was not completed for the project.

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.
2. Contractor shall cooperate with testing laboratory and geotechnical engineer in coordination of compaction tests.

1.3 REFERENCES

A. Standard Specifications for Highway Construction, 2024, 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. Soil Material 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 TOPSOIL

A. Topsoil shall consist of friable, fertile soil of a loamy character. Use suitable topsoil of uniform quality, free from hard clods, roots, sod, stiff clay, hard pan, stones larger than 1 inch (1/2 inch for turfgrass seeding), lime cement, ash, slag, concrete, tar residue, tarred paper, boards, chips, sticks, or any undesirable material.

B. Use on-site topsoil from sources within the project limits, unless compost-amended or off-site topsoil is specified.

1. On-site Topsoil: On-site topsoil material is material excavated from the top 8 inches of the site. Use of on-site topsoil material is subject to the Engineer's approval.
2. Compost-amended On-site Topsoil: Amend low-quality on-site topsoil, not meeting the requirements specified for off-site topsoil, with a minimum of 1 inch of compost for every 3 inches of topsoil. Use compost meeting the requirements of mulch for pneumatic seeding in Section 329219 "Seeding".

2.2 Off-site Topsoil: Contains at least 3% organic matter, according to ASTM D 2974, has a high degree of fertility, is free of herbicides that prohibit plant growth, has a pH level between 5.5 and 7.5, and meets the following mechanical analysis of at least 90 percent must pass the No. 10 sieve. The Engineer will approve the source of off-site topsoil. Surface soils from ditch bottoms, drained ponds, and eroded areas, or soils that are supporting growth of noxious weeds or other undesirable vegetation, will not be accepted. The Engineer will determine if testing is necessary. The Contractor will be responsible for payment of the testing if the off-site topsoil does not meet the above requirements. If the testing verifies the off-site topsoil does meet the above requirements, payment for the testing will be the responsibility of the Jurisdiction.

2.3 SOIL MATERIALS

A. General embankment and fill materials:

1. 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.

2. Material is subject to the approval of the A/E, and may be removed from onsite excavations or imported from off-site borrow areas.
3. The upper 12" of fill or embankment shall not have rocks greater than 1" in dimension.
4. For soils to be placed below water, use clean granular material.

B. Structure embankment and fill materials:

1. In addition to the General embankment requirements, soils placed beneath and within 10 feet structures or pavements shall have the following the requirements:

a. Cohesive soils must meet all of the following:

1) Liquid limit of less than 45% and a plasticity index greater than 10 and less than or equal to 25%.
2) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).

b. Granular soils must meet all of the following:

1) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
2) no more than 20% or less of fines passing the 200 sieve
3) Plasticity index of 3 or less

c. Drainage Layers:

1) Material consisting of clean crushed stone or gravel graded from 1" to no more than 5% passing the 200 sieve.

d. Crushed stone, crushed PCC, crushed composite pavement, or RAP; mixtures of gravel, sand, and soil; or uniformly-blended combinations of the above; as approved by the Engineer.

2. Subgrade Chemical Treatment (if necessary):

a. Cement: Meet the requirements of AASHTO M 85 for portland cement.
b. Fly ash: Provide Class C meeting the requirements of ASTM C 618 with a minimum of 22% CaO; the Loss of Ignition requirements in Table 1 will not apply. Approval of source required.
c. Lime: Hydrated lime should meet requirements of ASTM C 207, Type N or AASHTO M 216, and others.

C. Geotextile Materials:

1. Geotextile Fabric: Consisting of non-woven filaments of polyolefins or polyesters, meeting the following minimums:

a. Grab tensile Strength (lbs): 200 ASTM D 4632.
b. Elongation (%): 50 ASTM D 4632.
c. Trapezoidal Tear Strength (lbs): 75 ASTM D 4533.

2. Geogrid, Rectangular: Consisting of integrally-formed grid structure manufactured of a stress-resistant polypropylene material meeting the following minimums:

a. Minimum true initial modulus in use (lb/ft): 20,000 ASTM D 6637
b. Tensile strength, 2% strain (lb/ft): 400 ASTM D 6637
c. Flexural rigidity (mg-cm): 500,000 ASTM D 1388
d. Aperture Size (in): 1.0 minimum, 1.5 maximum

3. Geogrid, Triangular: punched and drawn polypropylene that is oriented in three substantially equilateral directions meeting the following minimums:

a. Tensar TX 140 and/or TX160, TX7 or approved equal.

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 worked 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 covered in subsequent specification sections.

C. 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. 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 Conditions.

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 one (1) or more acres of land compliance with the National Pollutant Discharge Elimination System (NPDES) Storm Water Permit is required.
2. A land disturbance permit is currently in place for this site (Permit #MOR100038):

    a. The Contractor and will be required to certify that he/she understands and will comply with all requirements of the permit.
    b. The Contractor shall be responsible for developing and implementing a storm water pollution prevention plan in accordance with good engineering practice.
    c. The plan shall identify potential sources of pollution, which may be expected to affect the quality of storm water discharges. In addition, the plan shall describe and ensure the implementation of practices which will be used to reduce the pollutants in the storm water discharges associated with the project. A copy of the permit form and a sample plan if not a part of these specifications can be obtained at the A/E's office.

3.4 TOPSOIL STRIPPING

A. Stripping and Salvaging Topsoil:

1. Mow all weeds, grass, and growing crops or other herbaceous vegetation close to the ground and remove from the site. Shred sod by shallow plowing or blading and thorough disking. Thoroughly shred to allow the soil to be easily spread in a thin layer over areas to be covered. If allowed by the Engineer, herbicides may be applied, and vegetation may be incorporated into the topsoil.
2. Remove an adequate amount of topsoil from the upper 8 inches of existing on-site topsoil to allow finish grading with a finished grade of 6 inches of salvaged or amended topsoil. The topsoil may be moved directly to an area where it is to be used, or may be stockpiled for future use.
3. Excess topsoil shall not be removed from the subdivision. It shall be stockpiled on the lots south of the site or as directed by the owner.

B. Preparation for Topsoil Placement:

1. Finish excavation and embankment work according to the specified grades and cross cross-sections; grade and slope all surfaces to drain away from buildings and prevent ponding. Conform to the grading plan within ± 2 inches.
2. Loosen surface to a minimum depth of 4 inches to reduce compaction.

C. Topsoil Spreading and Finish Grading:

1. Place the topsoil after all grading and trenching activities in the area have been completed.
2. Place topsoil at least 8 inches deep; smooth and finished grade according to the contract documents. If topsoil is being amended with compost, thoroughly blend compost with on onsite topsoil at the rate specified
3. After finish grading the topsoil, remove clods, lumps, roots, litter, other undesirable material, or stones larger than 1 inch (1/2 inch for turfgrass).
4. Excess topsoil shall not be removed from the subdivision. It shall be stockpiled on the lots south of the site or as directed by the owner, or incorporated into the embankment, if acceptable, in areas not requiring structural fill.

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. Drainage:

1. Provide temporary drainage facilities to prevent damage to public or private interests when necessary to interrupt natural drainage or flow of artificial drains.
2. Excavate and fill in a manner and sequence that will provide proper drainage at all times.
3. Restore original drainage as soon as work allows.

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 EMBANKMENT

A. Fill 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. Subgrade Preparation:

1. Remove vegetation, topsoil, obstructions, and deleterious materials from the ground surface prior to placement of embankment per Section 3.4 of this specification.
2. Disk excavated area to a depth of 8", unless sand or aggregate. Proof roll and prepare the surface per Section 3.8-D of this specification. Unsuitable material or material not achieving the specified stability, 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 or materials 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 and paid for in accordance with the General Conditions.

C. Subgrade Treatment:

1. Lime, Cement, or Fly Ash:

   a. Incorporate the subgrade treatment material uniformly during subgrade preparation to the depth and rate specified in the contract documents.
   b. Place subgrade treatment in the areas as specified or as directed by the Engineer.

2. Geogrid or Geotextiles:

   a. Install according to manufacturer's recommendations, on top of the prepared subgrade.
   b. Geogrid shall only be utilized when the aggregate base thickness will have a minimum of six (6) inches thick in order to prevent it from popping through the aggregate base. Minimum lap shall be 12" and minimum sewn lap shall be 4" or as specified by the manufacturer.
   c. Place subgrade treatment in the areas as specified or as directed by the Engineer.

D. Placing and compacting:

1. Place 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. Where 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. Provide not less than the following minimum densities for layer or lift of material placed:

1. Backfill or embankment under buildings, structures or within a 1:1 projected slope outside the finish structure grade @ 97% of Standard Proctor Density.
2. Backfill or embankment under pavements, walks, slabs or within a 1:1 projected slope outside the finish grade @ 98% of Standard Proctor Density.
3. All other backfill or embankment areas @ 85% of Standard Proctor Density.
4. Fills or embankments under buildings, structures, pavements, walks, slabs, and the projected slopes:

a. Prepared existing surface @ 90% of Standard Proctor Density.
b. The lower 1/4 of embankments greater than 4 ft in height but not exceeding the lower 2 ft. @ 90% of Standard Proctor Density.
c. Remainder as specified above.

C. Moisture control:

1. Moisture content for compaction purposes within building footprints shall be within the range of 2% below to 3% above optimum moisture as established by ASTM D 698.
2. Moisture content for subbase compaction purposes shall be within the range of 2% below to 2% above optimum moisture and granular base compaction purposes shall be within the range of 2% below to 2% above optimum moisture all as established by ASTM D 698.
3. 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.
   b. For material above the specified moisture parameters, air dry with disks and tillers or replaced with acceptable onsite soils at the Contractors expense. If moisture reduction is unable to be achieved after multiple attempts, due to temperature or excessive weather conditions the A/E may approve another method.

4. Process material to provide uniform moisture and clod reduction throughout.
5. Unsuitable material removed due to high moisture may be spread and allowed to dry until suitable.

D. Proof roll:

1. Prior to placement of granular subbase material on building and pavement areas, the subgrade shall be "proof rolled" with a minimum 25 ton gross vehicle weight (G.V.W.) truck to identify areas of soft or unstable subgrade. Permanent rutting in excess of 1" should be considered failure. Elastic (rebound) movement or rutting in excess of 1" 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 proof rolling should be immediately repaired and retested or removed and replaced with suitable material.

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 **Owner** 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. Pentrometer 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 D698):

    a. Paved Areas: 1 per 5000 sq ft per 8" lift.
    b. Building Area: 1 per 2500 sq ft per 8" lift.

4. Liquid Limit and Plasticity Index

    a. Building Area: 1 per each source of offsite fill material.

3.11 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 property in coordination with owner.

B. Remove from the Owner's Property waste materials, trash, debris, utility pipes, etc. to an approved legal waste site.

3.12 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.

3.13 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 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.

C. Perform Field Quality Controls Testing as specified herein.

1.3 PRODUCT HANDLING

A. Comply with pertinent provisions of relevant sections.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Standard Trench Excavation: All materials encountered during trench excavation, except rock and over-excavation.

1. Suitable Backfill Material: As noted in Section 2.1C
2. Unsuitable Backfill Material: Includes, but is not limited to, the following materials:

a. Soils not classified as suitable backfill material
b. Individual stones or concrete chunks larger than 6 inches and averaging more than one per each cubic foot of soil.
c. Frozen materials.
d. Stumps, logs, branches, and brush.
e. Trash, metal, or construction waste.
f. Soil in clumps or clods larger than 6 inches, and without sufficient fine materials to fill voids during placement.
g. Environmentally contaminated soils.
h. Materials removed as rock excavation or over-excavation.

3. Rock Excavation: Boulders or sedimentary deposits that cannot be removed in trenches without continuous use of pneumatic tools or blasting.
4. Over-excavation: Excavation of unsuitable or unstable material in trenches below the pipe zone

B. Bedding Materials:

1. Aggregate materials in accordance with Class II Material: Manufactured and non-manufactured open-graded (clean) or dense-graded (clean) processed aggregate, clean sand, or coarse-grained natural soils (clean) with little or no fines.

C. Trench 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 percent.
3. Structural Fill: Cohesionless granular materials free from organic material and other foreign matter, complying with the requirements of Class III materials
4. Clean Granular Materials: Class II Material: Manufactured and non-manufactured open-graded (clean) or dense-graded (clean) processed aggregate, or coarse-grained natural soils (clean) with little or no fines.

2.2 TOPSOIL

A. Where and if shown on the Drawings of otherwise required, provide topsoil consisting 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 No. 10 sieve and the pH must be between 5.0 and 8.0.

B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources

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.

C. 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. 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 Drawings. 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, 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.
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 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.
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 Conditions.

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. 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

E. of character of materials and obstructions encountered.

3.5 PIPE BEDDING

A. Place bedding material in the bottom of the trench in lifts no greater than 6 inches thick. Consolidate and moderately compact bedding material.

B. Shape bedding material to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe. Excavate for pipe bells.

C. Install pipe and system components.

D. Place, consolidate, and moderately compact additional bedding material adjacent to the pipe to a depth equal to 1/6 the outside diameter of the pipe.

3.6 HAUNCH SUPPORT

A. Granular Material:

1. Place aggregate material in lifts no greater than 6 inches thick.

2. Consolidate and moderately compact by slicing with a shovel or using other approved techniques.

B. Suitable Backfill Material:

1. Place in lifts no greater than 6 inches thick.
2. For suitable backfill materials, compact to at least 95% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture of -2% to 3% above optimum moisture content.

3.7 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. Placing and compacting:

1. Place backfill 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. Hydraulic compaction (flooding with water) is not allowed unless authorized by the Engineer.
6. Place backfill and fill materials evenly adjacent to structures, to required elevations.
7. 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.

3.8 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.

1. Backfill under buildings or structures @ 97% of maximum density (compact to at least 70% relative density for clean aggregates).
2. Backfill under pavements and walks @ 98% of maximum density (compact to at least 75% relative density for clean aggregates)
3. All other backfill @ 90% of maximum density (compact to at least 60% relative density for clean aggregates).
4. Compaction by jetting is not allowed.

3.9 FIELD QUALITY CONTROL

A. Trench compaction testing is the **Owner's** responsibility and they shall provide testing of trench backfill material using the services of an independent testing laboratory.

B. Soil Testing:

1. Cohesive Soils:

   a. Determine moisture-density relationships by ASTM D 698 (Standard Proctor). Perform at least one test for each type of cohesive soil used.
   b. Determine in-place density and moisture content. Use ASTM D 1556 (sand-cone method) and ASTM D 2216 (laboratory moisture content), or use ASTM D 698 (nuclear methods for density and moisture content).

2. Cohesionless Soils:

   a. Determine maximum and minimum index density and calculate relative density using ASTM D 4253 and ASTM D 4254.
   b. For clean aggregate granular bedding material and backfill, determine gradation according to ASTM C 136.

C. Field Testing:

1. Testing Frequency and Locations: Perform testing of the final trench backfill, beginning at a depth of 2 feet above the top of the pipe, as follows:

   a. Coordinate the timing of testing with the Engineer.
   b. The Engineer/Inspector will determine the location of testing.
   c. For each 2 vertical feet of consolidated fill, provide tests at a maximum horizontal spacing of 200 feet and at all street crossings.
   d. Additional testing may be required by the Engineer in the event of non-compliance or if conditions change.

e. If necessary, excavate to the depth and size as required by the Engineer to allow compaction tests. Place backfill material and recompact.

2. Test Failure and Retesting: Rework, recompact, and retest as necessary until specified compaction and moisture content is achieved in all areas of the trench. In the event of failed tests, the Engineer may require retesting as deemed necessary.

3.10 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. Furnish all materials; install, construct, maintain, and remove specified erosion control devices; at locations specified in the contract documents, or where specified by the Engineer.

B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified, from initial construction stages to final completion of the project

C. Other related documents.

1.2 GENERAL

A. The Contractor shall manage his operations to control water pollution in accordance with this specification and applicable State and Local 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. Storm Water Pollution Prevention Plan (SWPPP): A plan required by the Land Disturbance 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.

B. Best Management Practice (BMP): Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

1.4 SUBMITTALS

A. Product data: If requested by the Engineer/Architect (A/E), 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.

3. :

a. The Contractor and will be required to certify that he/she understands and will comply with all requirements of the permit.

b. The Contractor shall be responsible for developing and implementing a storm water pollution prevention plan in accordance with good engineering practice.

B. A land disturbance permit is currently in place for this site (Permit #MOR100038). 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 RELATED SECTIONS

A. Section 312300 – Excavation and Fill.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary slope drains: Stone, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe or flexible rubber pipe.

B. Geotextile Silt Fence:

1. Fabric: material conforming to Standard Specifications Section 1080.02
2. Posts: 4 foot minimum steel (T-section) weighing at least 1.25 pounds per foot, exclusive of anchor plate. Painted posts are not required, or a minimum cross-sectional area of 2” x 2” nominal size.
3. Fastener: Wire or plastic ties with a minimum tensile strength of 50 pounds.

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. Filter Sock

1. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 5 mil thickness, photodegradable HDPE.

E. Erosion Control Blankets

1. Short Term Erosion Control Blanket, Functional longevity of between 3 and 12 months and classified as follows:
   a. Single-net erosion control blankets and open weave textiles, consisting of an erosion control blanket composed of processed degradable natural or polymer fibers, mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix, or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.
2. Long Term Erosion Control Blanket, Functional longevity of 36 months and classified as follows:

a. Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

F. Turf Reinforcement Mats (TRM)

1. TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Meet the minimum material and performance requirements contained below:

a. Grab tensile Strength (lb/ft): 240 ASTM D 6818.

b. UV Stability (%): 80 - ASTM D4355 (1000 Hour Exposure)

c. Allowable Shear Stress (lb/sq ft): 10 ASTM 6460

d. Maximum Slope Grade: 1:1(H:V) or Flatter

G. 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. Silt fence ditch checks: Geotextile meeting the requirements of this specification.

H. Rock Ditch Liner:

1. The rock ditch liner shall meet the following requirements for the MoDOT Standard Specifications, current edition or 2022:

a. Section 609.60.2.1 Type 1 Rock Ditch Liner shall consist of material with a predominant rock size of 3 inches, a maximum rock size of 6 inches and a gradation such that no more than 15 percent will be less than one inch.

b. Section 609.60.2.2 Type 2 Rock Ditch Liner shall consist of material with a predominant rock size of 6 inches, a maximum rock size of 10 inches and a gradation such that no more than 15 percent will be less than 3 inches.

c. Section 609.60.2.3 Type 3 Rock Ditch Liner shall consist of material with a predominant rock size of 12 inches, a maximum rock size of 20 inches and a gradation such that no more than 15 percent will be less than 4 inches.

d. Section 609.60.2.4 Type 4 Rock Ditch Liner shall consist of material with a predominant rock size of 19 inches, a maximum rock size of 28 inches and a gradation such that no more than 15 percent will be less than 6 inches.

e. Section 609.60.2.5 Bedding material shall be used under Type 3 and Type 4 Rock Ditch Liner. Bedding material shall consist of crushed stone or gravel with a gradation consisting of 100 percent passing the 3-inch sieve, 30 to 70 percent passing the 1 1/2-inch sieve and 0 to 15 percent passing the No. 4 sieve.

2. All stone for the protection work shall be of a hard, durable quality such as will not disintegrate under the elements or be easily broken in handling. It shall be clean and free from earth, dust, or other refuse. The faces of individual pieces of stone shall be roughly angular, not rounded in shape. Field stone will not be accepted. The stone meeting the requirements herein shall be as designated by the Missouri Department of Transportation. Standard specifications, 2018. Broken concrete is not acceptable material.

I. Temporary Pipe:

1. PVC, HDPE, and metal pipes as specified in Standard Specifications Sections 1020, 1047, and 1028

J. 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.

2.2 CERTIFICATION AND SAMPLING:

A. The Contractor shall furnish a manufacturer's certification, stating the material conforms to the requirements of these specifications.

B. The certification shall include, or have attached, typical results of tests for the specified properties, representative of the materials supplied.

C. 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. If Contractor determines that any BMP should need modification, the changes shall be dated and documented, and all necessary field changes performed.

F. Perform inspections according to and at frequency required by the General Permit and local governing agencies

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 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.

3.4 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.

3.5 TEMPORARY SLOPE DRAINS

A. 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. Temporary slope drains shall be anchored to prevent disruption by the force of the water flowing in the drain.

C. The inlet end shall be constructed to channel water into the drain.

D. The outlet ends of these temporary slope drains shall have some means of dissipating the energy of this water to reduce erosion downstream.

E. 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.

3.6 GEOTEXTILE SILT FENCE

A. Installation:

1. Install material along the contour of the ground, as specified in the contract documents, or as directed by the Engineer.

2. Install silt fence with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when situations will not allow soil slicing, as determined by the Engineer.

3. Construct a "J-hook" at each end of a continuous run of silt fence, by turning the end of the silt fence uphill, as necessary to prevent runoff from flowing around ends when water behind the fence ponds to a level even with the top of the fence.

4. Insert 12 inches of fabric to a minimum depth of 6 inches (fabric may be folded below the ground line).

5. Compact installation by driving along each side of the silt fence, or by other means, as necessary to adequately secure the fabric in the ground, to prevent pullout and water flow under the fence.

6. Drive posts into the ground alongside the silt fence, to a minimum depth of 20 inches, unless otherwise specified by the Engineer. Space posts as shown on these construction documents.

B. Maintenance:

1. Repair or replace non-functioning silt fence that allows water to flow under the fence, is torn, or is otherwise damaged, due to inadequate installation, at no additional cost to the Owner.

2. When accumulated sediment reaches a level one-half the height of the fence, remove the silt fence as described above, and replace according to the installation instructions above.

C. Removal:

1. Remove the silt fence upon final stabilization of the project area, or according to the staging indicated in the SWPPP.

2. Remove and dispose of silt fence and posts.

3. Remove sediment or spread to match finished grade; ensure proper drainage.

4. Stabilize the area disturbed by removal operations.

3.7 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.

3.8 FILTER SOCKS

A. Installation:

1. Fill mesh filter sock with filler material to the size and length specified in the contract documents.
2. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.
3. Construct a “J-hook” at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.
4. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.
5. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.
6. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.

B. Maintenance:

1. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock 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. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.

3. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.

4. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.

5. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.

3.9 EROSION CONTROL BLANKET

A. Slope Application

1. Grade and smooth surface. Remove all rocks, clods, vegetation, or other obstructions that will prevent direct contact between the erosion control blanket and the soil surface.

2. When specified, prepare seedbed and place seed and fertilizer according with these specifications prior to placing erosion control blanket.

3. Install anchor trench at top of slope. Seed and fertilize trench after backfill and compaction, if seeding is specified.

4. Unroll the erosion control blanket down or horizontally across the slope.

5. Place consecutive blankets down the slope end-over-end, shingle style.

6. Overlap ends of consecutive rolls a minimum of 3 inches, and install anchors at a maximum spacing of 18 inches along all overlaps.

7. Overlap edges of adjacent rolls a minimum of 2 inches.

8. Install anchors at edge seams between rows.

B. Channel/Ditch Application:

1. When specified, prepare seedbed and place seed and fertilizer according with these specifications prior to placing erosion control blanket.

2. Place end of first roll in the anchor slot at the center of the upstream channel and secure with anchors.

3. Position adjacent rolls in the anchor slot, overlapping adjacent rolls a minimum of 3 inches.

4. Place backfill material in anchor slot and compact. Unroll erosion control blanket over compacted slot and secure with anchors.

5. Unroll erosion control blanket downstream. Maintain a minimum 3 inch overlap between adjacent rolls. Secure edge lap with anchors.

6. Install intermittent staple check slots every 30 feet.

7. Construct end lap at end of roll and beginning of new roll. Overlap roll ends with upstream erosion control blanket on top.

8. Excavate longitudinal trench along both sides of the channel at the outside edges of installation. Place outer edges of erosion control blanket into longitudinal slot. Install anchors, place backfill material, and compact.

9. Terminate installation at downstream end with staple check.

10. Install anchors in a regular pattern over entire area covered according to manufacturer's published recommendations (minimum three anchors per square yard).

3.10 TURF REIFORCEMENT MATS (TRM)

A. Install according to the manufacturer's published installation literature for the product specified and application (slope or channel).

3.11 DITCH CHECKS

A. Installation:

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 silt fence ditch checks in accordance with the drawing detail.

B. 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.

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. Remove the check dam and dispose of materials, or salvage to the contractor.

3. Remove the accumulated sediment or spread to match finished grade; ensure proper drainage.

4. Stabilize the area disturbed by removal operations.

3.12 ROCK DITCH LINER

A. Installation:

1. Subgrade shall be graded to elevations shown on the drawings.

2. Keys shall be excavated to elevations shown on the drawings.

3. All excavated spoil shall be placed in an area designated by the Owner. Spoil materials shall be graded to provide a smooth transition and shall be suitable for seeding.

4. The rock ditch liner shall be placed to the lines and grades shown on the drawings.

5. The rock ditch liner shall be placed to achieve the depth shown on the drawings.

6. The final surface shall be free of mounds and windrows using hand or machine leveling as required to achieve a uniform, reasonably even surface.

7. The rock ditch liner shall be placed beginning at the bottom of the slope working upward using a method to minimize segregation of the various sized riprap components.

8. Excess handling or the passage of heavy equipment over the rock ditch liner which cause breakage of the stones shall be avoided.

9. Compaction of the rock ditch liner is not required.

10. Fill slopes above rock ditch liner as required to produce the grades indicated on the Drawings.

3.13 TEMPORARY PIPE

A. Installation:

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. Discharge slope drain to a stable outlet or to a sediment retention device.

3.14 TEMPORARY SEEDING AND MULCHING

A. Installation:

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.

3.15 SEDIMENT REMOVAL

A. Sediment deposits shall be removed when:

1. The deposits reach approximately one-half the height of a ditch check, straw bale barrier or silt fence.

2. The sediments have reduced the ponded volume of sediment basins to one-third of the original volume.

3. 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.

PART 4 - APPENDIX

4.1 MODOT standard specifications referenced by this document follow, and are removed from "Missouri Standard Specifications for Highway Construction", 2025 Third Edition, January 2026.

SECTION 806
POLLUTION, EROSION AND SEDIMENT CONTROL

806.1 Description. This work shall consist of furnishing, installing, maintaining and removing temporary pollution, erosion and sediment control measures; furnishing and placing permanent erosion control features; or a combination of both as shown on the plans or as directed by the engineer.
806.2 Schedule of Work. Prior to the preconstruction conference and the start of construction, the contractor shall submit schedules for the implementation of temporary pollution control and temporary and permanent erosion control work, as applicable, for construction operations. The contractor's schedule shall address specifically the pollution and erosion control measures planned at all streams or other bodies of water. No work shall start until the pollution and erosion control schedules and methods of operations have been approved by the engineer. Any delay of the work resulting from failure to submit acceptable pollution and erosion control schedules and methods of operations will be considered nonexcusable.
806.3 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as herein.
806.4 Construction Requirements. The engineer will limit the surface area of erodible earth material exposed by clearing and grubbing or by excavation, borrow and fill operations in accordance with the following. The engineer may direct the contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other bodies of water. Such work may involve the construction of temporary berms, dikes, dams, sediment basins and slope drains, and use of temporary mulches, seeding or other control devices or methods as necessary to control erosion and pollution.
806.4.1 If erosion and sediment control measures, as shown on the plans, are not suitable due to site conditions, a suitable system of Best Management Practices (BMP) as defined by the applicable Missouri State Operating Permit for land disturbance activities and the Stormwater Pollution Prevention Plan (SWPPP), shall be applied as approved by the engineer.
806.4.2 The contractor shall exercise effective management practices throughout the life of the project to control pollution. Pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage or other harmful material shall not be discharged on or from the project. Temporary pollution control measures, such as storage and handling of petroleum products and other pollutants, shall be coordinated with temporary and permanent erosion and sediment control features specified in the contract to ensure economical, effective and continuous erosion and pollution control. These requirements will also apply to work within easements designated by the Commission.
806.4.3 The contractor shall incorporate all permanent erosion, sediment, and pollution control features into the project at the earliest practical time. Temporary measures shall be used to correct conditions that develop during construction which were not foreseen during the design stage, that are needed prior to installation of permanent pollution control features, or that are needed temporarily to control erosion and sediment that develops during normal construction practices, but are not associated with permanent control features on the project.
806.4.4 Installation of temporary control measures shall be scheduled to coincide with clearing and grubbing operations, but before grading operations begin. The project land area disturbance shall not exceed one acre without installation of erosion and sediment controls. The total project land disturbance area shall not exceed 20 acres without written approval from the engineer.
806.4.5 The engineer may allow additional land disturbance acreage if appropriate BMP's including temporary seeding and mulching, have been applied to previously disturbed areas and the contractor has the resources to apply the BMP's to the expanded area.
806.4.6 Unless otherwise provided or approved in writing by the engineer, construction operations in streams or other bodies of water shall be restricted to those areas that must be entered for the construc-

tion of temporary or permanent structures. Streams or other bodies of water shall be promptly cleared of all falsework, piling, debris or other obstructions placed therein or caused by construction operations.
806.4.7 Fording of streams or other bodies of water with construction equipment will not be permitted, except as allowed by the engineer. Temporary bridges or other structures shall be used when frequent crossing of streams or other bodies of water is necessary. Unless otherwise approved in writing by the engineer, mechanized equipment shall not be operated in streams or other bodies of water except as may be required to construct channel changes and temporary or permanent structures. If a Corps of Engineer Section 404 or Department of Natural Resources Section 401 permit is applicable for a project, the permit requirements and conditions will prevail.
806.4.8 The contractor shall obtain all necessary permits for all project support activities located off the project site. Project support activities include, but are not limited to, borrow areas, waste areas, plant sites, and staging areas. All costs associated with the permits and pollution control shall be at the contractor's expense, including providing, installing, maintaining, and removal of all erosion and sediment control devices, and final stabilization of disturbed areas.
806.4.9 In the event of conflict between these requirements and the pollution control laws, rules or regulations of other federal, state or local agencies, the more restrictive laws, rules or regulations will apply.
806.4.10 The contractor is encouraged to incorporate mulch from the clearing and grubbing operation into the BMP's on the project. BMP's may consist of compost filled socks, compost filter berms, soil protection cover or any other method as approved by the engineer.
806.4.11 Unless otherwise specified, or directed by the engineer, all temporary erosion and sediment control measures shall be removed by the contractor after permanent erosion and sediment control measures are established and the project has achieved final stabilization as defined in the SWPPP. Biodegradable erosion and sediment control materials may be allowed to be incorporated into the project in accordance with the SWPPP, as approved by the engineer. Rock from ditch checks and other temporary sediment devices may be repositioned to serve as ditch liner in accordance with the SWPPP, and as directed by the engineer.
806.4.12 Portland cement concrete residue and wash water and other operations that produce sediment laden runoff shall be managed by an appropriate control measure.
806.4.12.1 Portland cement concrete residue and wash water shall be discharged into a plastic lined pit, plastic lined straw bale enclosure, or other commercially available water tight enclosure suitable for containing concrete residue and wash water as approved by the Engineer.
806.4.12.2 Water from aggregate washing and other operations that produce sediment laden water shall be treated by filtration, settling basins, or other means sufficient to comply with the general water quality criteria established by MDNR.
806.4.12.3 No direct payment will be made for the design, installation, maintenance or removal of controls necessary to contain Portland cement concrete residue and wash water or other water from sediment producing operations.

SECTION 806.10 TEMPORARY BERMS.

806.10.1 Description. This work shall consist of constructing and maintaining temporary berms at the top of slopes or transverse to the centerline of fills as shown on the plans.
806.10.2 Material. Type B berms shall consist of graded material from within the project limits, rock, or other suitable material approved by the engineer. Type C berms shall consist of rock with a predominant size between 4 inches and 12 inches.
806.10.3 Construction Requirements. Temporary berms shall be constructed and maintained to the approximate dimensions shown on the plans.
806.10.3.1 Type B Berms. Type B berms shall be machine compacted with a minimum of three passes over the entire width of the berm. Material removed from Type B berms shall be incorporated in the embankment when possible. The contractor shall remove and dispose of any excess or unsuitable material to a location approved by the engineer.
806.10.3.1 Type B berms shall drain to a compacted outlet at slope drain. On transverse berms, the top width of the berms may be wider and the side slopes flatter to allow equipment to pass over these berms with minimal disruption.
806.10.3.2 Type C Berms. Vegetative mulch, erosion control blanket or geotextile fabric, if required by the engineer, shall be placed on the upslope of the Type C berm. The vegetative mulch shall be placed in such a manner that the final compacted thickness is 2 inches. The material for the vegetative mulch shall be in accordance with Sec 802. The vegetative mulch erosion control blanket or geotextile fabric shall be removed and replaced as directed by the engineer.

806.10.4 Method of Measurement. Measurement of Type B and C berms will be made to the nearest linear foot.
806.10.5 Basis of Payment. The accepted quantities of Type B and C berms will be paid for at the contract unit price and will be considered full compensation for material, installation, maintenance, removal and any other hand work necessary to construct the berms. No payment will be made for the straw layer, erosion control blanket or geotextile fabric on the Type C berm. No payment will be made for any seeding and mulching needed after removal.

SECTION 806.20 TEMPORARY SLOPE DRAINS.

806.20.1 Description. This work shall consist of furnishing, constructing maintaining and removing temporary slope drains to carry water down slopes and to reduce erosion. The method selected shall be approved by the engineer prior to construction.
806.20.2 Construction Requirements. The contractor shall provide temporary, impermeable slope drains to carry water or water with suspended solids down fill slopes until permanent erosion control measures are established. The contractor shall provide temporary slope drains on fillslopes at approximately 500-foot intervals or as directed by the engineer. All temporary slope drains shall be adequately anchored to the slope to prevent disruption of flow. The inlet ends shall include a ditch check and be constructed to channel water into the temporary slope drain. Outlet ends shall have some means of dissipating the energy of the water to reduce erosion downstream and have the ability to capture sediment. After removal, the contractor shall restore the site of the slope drains to the satisfaction of the engineer.
806.20.3 Method of Measurement. Measurement of temporary slope drains will be made to the nearest linear foot.
806.20.4 Basis of Payment. The accepted quantities of temporary slope drains will be paid for at the contract unit price. Payment shall include furnishing, constructing, maintaining and removing temporary slope drains, and restoration of the slope drain sites. No payment will be made for any seeding and mulching needed after removal.

SECTION 806.30 TEMPORARY DITCH AND INLET CHECKS.

806.30.1 Description. This work shall consist of furnishing, constructing, maintaining, removing and disposing of temporary ditch and inlet checks.
806.30.2 Construction Requirements.

806.30.2.1 Rock Ditch Checks. Rock ditch checks shall be constructed in accordance with the plans, or as directed by the engineer, and shall have a minimum effective height of 18 inches. The predominant size of the rock used shall range between 4 inches and 12 inches.
806.30.2.2 Alternate Ditch Checks. Alternate ditch checks shall be constructed in accordance with the manufacturer's specifications, and as shown on the plans, or as directed by the engineer. Alternate ditch checks shall have a minimum effective height of 9 inches, shall follow guidance provided in the SWPPP, and shall perform to the level that meets or exceeds the requirement of the current Missouri Operating Permit.
806.30.2.2.1 Compost filter socks used for alternate ditch checks shall meet the requirements of AASHTO R51. Other proprietary devices may be used, as approved by the engineer. Acceptance of the material will be based on the manufacturer's certification and upon acceptable performance in the field, as determined by the engineer. **806.30.2.2.2** Unless otherwise disallowed, the contractor has the option to construct rock ditch checks in lieu of alternate ditch checks. Rock ditch checks constructed in lieu of alternate checks shall have a minimum effective height of 18 inches. Spacing shall be increased, as determined by the engineer, to account for the additional height of rock ditch check. The toe-to-top capacity requirements shown on the plans will be used to determine the spacing.
806.30.2.3 Inlet Checks. Inlet checks shall be installed in accordance with the plans or as directed by the engineer to prevent sediment from entering drop inlets, manholes, and other openings to culverts and closed drainage systems.
806.30.2.3.1 Inlet checks shall be constructed in accordance with Sec 806.30.2.1, rock ditch checks, and shall completely surround the inlet or other structure, as indicated on the plans. Other allowable methods of protecting inlets will be listed in the SWPPP.
806.30.2.4 Curb Inlet Checks. Curb inlet checks shall consist of socks filled with rock, or other fillers of sufficient weight to keep the device in place. Compost filter socks used for curb inlet checks shall meet the requirements of AASHTO R51. Curb inlet checks shall be installed in the gutter or as shown on the plans. Other proprietary devices may be used, as approved by the engineer.

806.30.3 Maintenance. The contractor shall monitor the condition of all temporary checks and repair or replace checks that are not functional. The contractor shall remove sediment in accordance with Sec 806.110. Alternate ditch checks shall be maintained in accordance with this provision and the manufacturer's specifications or as directed by the engineer.
806.30.4 Removal. All types of temporary checks shall remain in service until removal has been approved by the engineer. Removal shall be in accordance with Sec 806.4.11 and as stated herein. The contractor shall remove any sediment from the check, remove the check, and restore the area to match existing ground condition. When necessary, seeding and mulching shall be in accordance with Secs 802 and 805 respectively, and shall be considered incidental.
806.30.5 Method of Measurement.

806.30.5.1 Measurement of rock ditch checks will be made to the nearest linear foot as measured along the top of the check. Rock ditch checks constructed in lieu of alternate checks will be included in this measurement for payment. Inlet checks, except for curb inlet checks, will be included in this measurement for payment.
806.30.5.2 Measurement of alternate ditch checks will be made to the nearest linear foot as measured along the top of the check.
806.30.5.3 No measurement will be made for any portion of a check that exceeds the length necessary to adequately span the ditch as shown on the plans or as directed by the engineer.
806.30.5.4 Measurement of curb inlet checks will be made per each check.
806.30.6 Basis of Payment.

806.30.6.1 The accepted quantities of rock ditch checks, alternate ditch checks, inlet checks, and curb inlet checks will be paid for at the contract unit price for each pay item included in the contract. If the engineer determines unusual conditions warrant complete replacement of a check, payment will be made for the replacement check at the contract unit price.
806.30.6.2 Payment for sediment removal shall be in accordance with Sec 806.110.
SECTION 806.40 SEDIMENT BASINS.

806.40.1 Description. This work shall consist of constructing and maintaining temporary or permanent sediment basins as shown on the plans or as directed by the engineer. This work shall include clearing and excavation to construct the basin, disposal of excavated material, and providing and installing rock or other stabilizing material as approved by the engineer. For temporary basins, removal, backfilling, and site restoration is also included in the work.
806.40.2 Construction Requirements. The sediment basin shall be an excavated or dammed storage area with defined side slopes. Inlet and outlet areas shall be lined with rock of sufficient size to withstand the water flow. In lieu of rock, other allowable liners may be used as described in the SWPPP. Outlets may be constructed with a riser pipe, surface skimmers, or stabilized spillway, or a combination of one or more of these features.
806.40.2.1 The inlet of a sediment basin shall be constructed with a wide cross-section and a minimum grade to prevent turbulence and to allow deposition of soil particles.
806.40.2.2 Sediment shall be removed and disposed in accordance with Sec 806.110, and before the depth reaches approximately one-half the original depth of the sediment basin in any part of the pool.
806.40.2.3 Temporary sediment basins shall remain in service until removal has been approved by the engineer. Removal shall be in accordance with Sec 806.4.11 and as stated herein. The contractor shall remove any sediment from the basin, backfill, compact all excavations, restore the area to match existing ground conditions, and seeding and mulching in accordance with Secs 802 and 805 respectively.
806.40.3 Method of Measurement.

806.40.3.1 Measurement of excavation to construct sediment basin will be made to the nearest tenth of a cubic yard.
806.40.3.2 Measurement of rock placed to construct sediment basins will be made to the nearest tenth of a cubic yard.
806.40.4 Basis of Payment.

806.40.4.1 The accepted quantities for excavation to construct sediment basins will be paid for at the contract unit price. Payment includes clearing, excavation, removal, backfilling and final grading.
806.40.4.2 The accepted quantity for rock used to construct sediment basins will be paid for at the contract unit price. Payment shall include furnishing, placing, and removal of rock.

806.40.4.3 No direct payment will be made for seeding and mulching necessary to restore the area after removal.
806.40.4.4 Payment for sediment removal shall be in accordance with Sec 806.110.

SECTION 806.50 TEMPORARY SEEDING.

806.50.1 Description. This work shall consist of furnishing and applying fertilizer and seed in disturbed areas as authorized by the engineer. Mulch shall be applied following temporary seeding in accordance with Sec 802. Temporary seeding and mulching is utilized to provide interim stabilization of disturbed areas where staging requires the area to be disturbed again at a later date, and for areas to be seeded with warm season grasses that are finish-graded, but application of permanent seeding is disallowed per Sec 805.3.1.2. Finish grading will not be required except for areas that will not receive further grading prior to permanent seeding. Hydraulic seeding and fertilizing in accordance with Sec 805 will be permitted.
806.50.2 Construction Requirements. Seeding and mulching shall be a continuous operation on all cut and fillslopes, excess material sites and borrow pits during the construction process. All disturbed areas shall be seeded and mulched as necessary to control erosion in accordance with the Missouri State Operating Permit. Seed bed shall be prepared in accordance with Sec 801. When the engineer allows the contractor to disturb additional ground beyond the restrictions in Sec 806.4.4 solely to enhance the contractor's operation, the contractor shall not receive compensation for temporary seed or mulch, as required by the engineer, for ground cover for areas exceeding the restrictions in Sec 806.4.4.
806.50.2.1 The contractor shall provide permanent seeding and mulching following temporary seeding in accordance with Sec 805. Any preparation of the seed bed that might be necessary prior to permanent seeding to ensure germination shall be considered incidental to temporary seeding. All washouts and rills shall be repaired at the contractor's expense prior to permanent seeding.
806.50.2.2 Temporary seeding mixtures of cereal grains shall be applied at a minimum rate of 100 pounds per acre. All erodible seeded areas shall provide a minimum of 20 plants of the species planted per square foot on at least two random counts per acre in representative areas of the field. For areas with a large percentage of rock, the number of living plants shall be proportional to the percentage of erodible surface, as determined by the engineer. The counts will be conducted 60 days after the species is planted.
806.50.2.3 Fertilizer shall be applied at a rate of 40 pounds nitrogen (N) per acre.
806.50.2.4 Lime will not be required for temporary seeding of unfinished areas. In finished areas, where temporary seeding is placed due to warm season grass planting time restrictions, 100 percent of the lime specified for warm season grasses shall be applied at the time of temporary seeding.
806.50.3 Method of Measurement. Measurement of temporary seeding areas will be made to the nearest tenth of an acre.
806.50.4 Basis of Payment. The accepted quantities of temporary seeding will be paid for at the contract unit price per acre. Payment for fertilizer shall be included in the cost of temporary seeding. When lime is applied in accordance with Sec 806.50.2.4 upon request from the contractor, payment for the lime application will be made as a partial payment for Seeding - Warm Season Grasses. The remaining payment for Seeding - Warm Season Grasses will be made after permanent seeding is complete.

SECTION 806.60 SEDIMENT TRAP.

806.60.1 Description. This work shall consist of constructing, maintaining and removing sediment traps as shown on the plans or as directed by the engineer.
806.60.2 Construction Requirements.

806.60.2.1 Sediment traps shall be constructed as shown on the plans or as directed by the engineer. Traps may require excavation, or placement of rock of sufficient size to impound water, or a combination of excavation and placement of rock.
806.60.2.2 Sediment traps shall be installed with clearing and grubbing operations or as directed by the engineer. The contractor shall monitor sediment levels and remove sediment in accordance with Sec 806.110.
806.60.2.3 Sediment traps shall remain in service until removal has been approved by the engineer. Removal shall be in accordance with Sec 806.4.11 and as stated herein. The contractor shall remove any sediment from the trap, backfill, compact all excavations, restore the area to match existing ground condition, and seeding and mulching in accordance with Secs 802 and 805 respectively.
806.60.3 Method of Measurement.

806.60.3.1 Measurement of excavation to construct sediment traps will be made to the nearest tenth of a cubic yard.
806.60.3.2 Measurement of rock placed to construct sediment traps will be made to the nearest tenth of a cubic yard.
806.60.4 Basis of Payment.

806.60.4.1 The accepted quantity for excavation to construct sediment traps will be paid for at the contract unit price. Payment includes clearing, excavation, removal, backfilling, and final grading.
806.60.4.2 The accepted quantity for rock used to construct sediment traps will be paid for at the contract unit price. Payment shall include furnishing, placing, and removal of rock.
806.60.4.3 No direct payment will be made for seeding and mulching necessary to restore the area after removal.
806.60.4.4 Payment for sediment removal will be in accordance with Sec 806.110.
SECTION 806.70 SILT FENCE.

806.70.1 Description. This work shall consist of furnishing, installing, maintaining, and removing of a silt fence to control sediment along slopes and other designated areas. The quantity of silt fence shown on the plans may be increased or decreased, as directed by the engineer. The engineer may also modify the location as necessary to improve the effectiveness of the silt fence. Variations in quantity and location will not be considered as a change in work.
806.70.2 Material. When geotextile fabric is used, material shall be in accordance with Sec 1011. All other material shall be as specified in the SWPPP.
806.70.2.1 Posts. Wood, steel or synthetic posts may be used. Posts shall be of sufficient length, but no less than 4 feet, to ensure adequate embedment while fully supporting the fence and shall have sufficient strength to resist damage during installation and to support applied loads while in service.

806.70.2.2 Prefabricated Fence. Prefabricated fence systems may be used if the systems meet all of the above material requirements.
806.70.3 Construction and Maintenance Requirements.

806.70.3.1 Fabric Fence. The contractor shall install silt fence as shown on the plans and at other locations directed by the engineer. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading. Fabric at the bottom of the fence shall be buried a minimum of 6 inches to prevent flow under the barrier. The trench shall be backfilled, and the soil compacted over the fabric. Fabric splices with a minimum 2foot overlay shall be located only at a support post. Any installation method acceptable to the engineer will be allowed as long as the effectiveness and intent of the silt fence is achieved.
806.70.3.1.1 Post spacing shall not exceed 5 feet. Posts shall be driven a sufficient depth into the ground or placed on closer spacing as necessary to ensure adequate resistance to applied loads.
806.70.3.1.2 The silt fence shall be fastened securely to the upslope side of the post. When wire support fence is used, the wire shall extend into the trench a minimum of 2 inches.
806.70.3.2 Alternate Fence Types. Alternate fence types shall have a minimum effective height of 9 inches, shall follow guidance provided in the SWPPP, and shall perform to the level that meets or exceeds the requirement of the current Missouri Operating Permit. Compost filter socks meeting the requirements of AASHTO R51 may be used as an alternate to fabric silt fence. Additional alternate silt fence types shall be in accordance with the SWPPP or as approved by the engineer. Acceptance of the material will be based on the manufacturer's certification and upon acceptable performance in the field, as determined by the engineer.
806.70.3.3 Maintenance. The contractor shall monitor the condition of all fences and repair or replace fences that are not functional as long as the fences are necessary to contain sediment runoff. Any deficiencies shall be corrected by the contractor in accordance with the SWPPP. In addition, the contractor shall review the effectiveness of silt fences in areas where construction activities have changed the natural contour and drainage runoff. Where deficiencies exist, additional silt fences shall be installed as approved or directed by the engineer.
806.70.3.4 Sediment. The contractor shall remove and dispose of sediment in accordance with Sec 806.110. Segments of silt fence that receive heavy sediment loading may require a secondary silt fence or installation of other controls to adequately contain sediment.
806.70.3.5 Removal. Silt fence shall be removed in accordance with Sec 806.4.11 and as specified herein. The contractor shall remove and dispose of any excess silt accumulation along the fence, shall restore

the area to match existing ground condition, and seeding and mulching in accordance with Secs 802 and 805 respectively.
806.70.4 Method of Measurement. Silt fence will be measured to the nearest linear foot from end to end of each separate installation.
806.70.5 Basis of Payment.

806.70.5.1 The accepted quantities of silt fence will be paid for at the contract unit price.
806.70.5.2 No direct payment will be made for seeding and mulching necessary to restore the area after removal.
806.70.5.3 Payment for sediment removal will be in accordance with Sec 806.110.

SECTION 806.80 TEMPORARY PIPE.

806.80.1 Description. This work shall consist of installing and removing temporary pipe utilized to carry water under temporary roadways, silt fences, berms or other locations determined by the engineer.
806.80.2 Material. Any pipe approved by the engineer may be used.
806.80.3 Construction Requirements. Installation of temporary pipe shall be in accordance with the specifications for permanent pipe and shall prevent water from causing erosion around the pipe. All backfill material for pipes shall be placed in 6-inch lifts and mechanically compacted. Compaction tests will not be required. Temporary pipe placed in intermittent or active streams for the convenience of the contractor shall be installed in accordance with Sec 806.100 and any applicable permits.
806.80.4 Method of Measurement. Measurement of temporary pipe will be made to the nearest linear foot for those pipes specified on the plans.
806.80.5 Basis of Payment. The accepted quantities of temporary pipe will be paid for at the contract unit price for temporary pipes specified on the plans. No payment will be made for temporary pipes that the contractor chooses to install to facilitate construction. Unless provided as a pay item in the contract documents, no direct payment will be made for the placement and removal of the backfill material or rock.

SECTION 806.90 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS.

806.90.1 Description. This work shall consist of furnishing and placing erosion control blankets (ECBs) and turf reinforcement mats (TRMs) on slopes or ditches for short-term or long-term protection of seeded areas at locations shown on the plans or as directed by the engineer.
806.90.2 Material. ECBs and TRMs shall be used as designated in the contract or as approved by the engineer. The contractor shall provide ECBs and TRMs of the type specified in the contract and shall provide a manufacturer's certification stating that they are in accordance with Sec 1011.
806.90.3 Construction Requirements. ECBs and TRMs shall be installed and maintained according to the manufacturer's recommendations.
806.90.4 Method of Measurement. Measurement of ECBs and TRMs will be made to the nearest square yard of surface area covered.
806.90.5 Basis of Payment. The accepted quantity of ECBs and TRMs will be paid for at the contract unit price for each of the pay items included in the contract. If ECBs and TRMs are used in lieu of other erosion control measures, payment will be made at the contract unit price for the pay items in the contract for the respective items that the blanket replaces.

SECTION 806.100 TEMPORARY STREAM CROSSING.

806.100.1 Description. This work shall consist of constructing a temporary stream crossing to facilitate the movement of equipment across a stream.
806.100.2 Construction Requirements. The contractor shall be responsible for the design, installation, maintenance and removal of the temporary stream crossing and any structures installed for the construction of the temporary stream crossing. Appropriate measures shall be taken to maintain near normal downstream flows and to minimize flooding upstream. The temporary stream crossing shall be constructed to permit the free movement of the stream's aquatic life. Fill material shall be clean rock of sufficient size to withstand expected high flows. Only graded rock and/or quarry-run rock shall be used. The rock must be reasonably well graded, with no particle dimension greater than approximately 12 inches, and no particle dimension less than approximately 9 inches. Gravel and dirt should not exceed 15% of the total fill volume.
806.100.2.1 Prior to construction of the temporary stream crossing, all information shall be submitted to the engineer to ensure that it meets the terms and conditions of the Corps of Engineer permit. The contractor shall not begin construction on any temporary stream crossing without written permission from the engineer.

806.100.2.2 All approaches to the temporary stream crossing shall be maintained such that all storm water runoff is diverted to retention devices.
806.100.2.3 When the temporary stream crossing is no longer needed, the crossing shall be removed as soon as possible and the area shall be restored to pre-project conditions or to the satisfaction of the engineer.
806.100.3 Basis of Payment. No direct payment will be made for the design, installation, maintenance or removal of temporary stream crossings. The contractor shall be responsible for all costs, including damage and penalties.
SECTION 806.110 SEDIMENT REMOVAL.

806.110.1 Description. This work shall consist of removing and disposing of sediment from sediment control devices, such as ditch and inlet checks, sediment basins, sediment traps, silt fence, and other devices that accumulate sediment.
806.110.2 Construction Requirements. The contractor shall monitor sediment levels in all sediment control devices and remove sediment prior to the level reaching approximately one-half the design heights for checks and fences, and one-half the storage capacities for basins and traps. The engineer may require sediment removal from devices prior to levels reaching the specified limits.
806.110.2.1 The contractor shall dispose of the sediment in a location that does not allow the sediment to erode back into the sediment devices or to pollute streams or other bodies of water.
806.110.3 Method of Measurement. Measurement of sediment removal will be made to the nearest tenth of a cubic yard.
806.110.3.1 No measurement will be made for sediment removal that accumulates due to the contractor's failure to complete erosion control measures in accordance with the SWPPP or as directed by the engineer. The engineer shall determine the volume of sediment that will be excluded from payment due to a lack of required erosion control measures.
806.110.3.2 No measurement will be made for removing any remaining sediment during final removal of the sediment control devices.
806.110.4 Basis of Payment. The accepted quantity of sediment removal will be paid for at the contract unit price.

END OF SECTION 312513

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide aggregate base courses on a prepared subbase where shown on the Drawings, and as specified herein.

1.2 SUBMITTALS

A. Comply with pertinent provisions of other Sections

B. If requested by the Engineer/Architect (A/E), within 15 calendar days after the Contractor has received the Owner's Notice Award, submit:

1. Certifications of material compliance for:

a. Aggregate base course
b. Geotextile fabric
c. Geogrid materials

1.3 REFERENCES

A. Standard Specifications for Highway Construction, 2024, Missouri Department of Transportation, herein noted as the Standard Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextile Fabric: As specified in Section 312300 Excavation and Fill.

B. Geogrid Material: As specified in Section 312300 Excavation and Fill.

C. Aggregate Base Course:

1. MoDOT Standard Specifications Article 1007.3 - Type 5

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Subgrade preparation shall be in accordance with Section 3.6 of 312300 Excavation and Fill of these specifications.

3.2 GEOTEXTILE FABRIC

A. Geotextile fabric when specified shall be placed on the prepared subbase prior to placement of the aggregate base course. Fabric of insufficient width or length to fully cover the specified area shall be lapped or sown. Minimum lap shall be 12" and minimum sewn lap shall be 4".

B. Placement of the base course on the fabric shall be accomplished in a manner as to prevent tearing or shoving of the material. Fabric damaged shall be repaired or replaced prior to placement of the base course.

3.3 GEOGRID

A. Geogrid when specified shall be placed on the prepared subbase prior to placement of the aggregate base course. When geogrid is used for stabilization, the aggregate base thickness shall be a minimum of six (6) inches thick in order to prevent it from popping through the aggregate base. Minimum lap shall be 12" or as specified by the manufacturer.

3.4 AGGREGATE PLACEMENT

A. General: The aggregate shall be uniform in gradation. The base course shall be constructed in layers not more than four (4) inches thick when compacted, except that if tests indicate that the desired results are being obtained, the compacted thickness of any layer may be increased to a maximum of six (6) inches. When placed, it shall be free from segregation and shall require minimum blading or manipulation. Immediately after the material has been placed, it shall be compacted with a tamping roller, a vibratory machine or combination of the two.

B. Compaction: Before the aggregate is deposited on the subgrade, the aggregate shall contain the amount of moisture required for compaction. The granular material shall be compacted to not less than 98 percent of the Standard Laboratory Density, determined in accordance with ASTM D 698. If test indicate that the base course does not comply with the density requirements, additional wetting, if necessary, and rolling will be required until the density is obtained. Moisture shall be added to the material during compaction only when it is necessary to increase the percentage of moisture to obtain the required density.

C. Staging: The aggregate base shall initially be placed and compacted to 90% of the design thickness shown on the Drawings. The remaining 10% of the aggregate base and final finishing shall be completed after the curbs and driveways are installed. The final surface shall be within + or - 0.5".

D. Flatness: Maximum variation of 1/2 inch measured with 10-foot straight edge.

3.5 FIELD QUALITY CONTROL

A. The **Owner** 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 the A/E.

C. Testing Requirements:

1. Determine moisture-density relationships by ASTM D 698 (Standard Proctor). Perform at least one test for each type of material used.

2. Provide not less 100% of maximum density of material compacted at optimum moisture content for the actual density of each layer of material in place.

3. Field density/moisture tests (ASTM D 698):

   a. Aggregate Base: 1 per 5000 sq ft.

PART 4 - APPENDIX

4.1 MODOT standard specifications referenced by this document follow, and are removed from "Missouri Standard Specifications for Highway Construction", 2025 Third Edition, January 2026.

SECTION 304
AGGREGATE BASE COURSE

304.1 Description. This work shall consist of furnishing and placing one or more courses of aggregate on a prepared subgrade in accordance with these specifications, and as shown on the plans or as directed by the engineer. The type of aggregate to be used will be specified in the contract.
304.2 Material. Material for Type 1, 5 and 7 aggregate bases shall be crushed stone or reclaimed asphalt or concrete which meet the requirements of Sec 1007.
304.3 Construction Requirements.

304.3.1 Field Laboratory. When authorized by the engineer, the contractor shall provide a Type 2 field laboratory in accordance with Sec 601. Payment for the laboratory will be made in accordance with Sec 601.
304.3.2 Subgrade. All work on that portion of subgrade on which the base is to be constructed shall be completed in accordance with Sec 209.2.1 prior to placing any base material on that portion. Aggregate base shall not be placed on frozen subgrade.
304.3.3 Placing.

304.3.3.1 The contractor shall place base material on the roadbed as shown in the contract documents. The maximum compacted thickness of any one layer shall not exceed 6 inches. If the specified compacted depth of the base course exceeds 6 inches, the base shall be constructed in two or more layers of approximately equal thickness. The compacted depth of a single layer of the base course may be increased to 8 inches for shoulders.
304.3.3.2 Types 1 and 5 aggregate base used for shoulders adjacent to rigid or flexible type pavement, including pavement resurfacing, shall be simultaneously deposited and spread on the subgrade. Aggregate shall not be deposited on the pavement and bladed or dozed into place.
304.3.4 Shaping and Compacting. Each layer shall be compacted to the specified density or dynamic cone penetration index value before another layer is placed.
304.3.4.1 Segregated surface areas constructed of Type 1 aggregate base may be corrected by adding and compacting limestone screenings of such gradation and quantity as required to fill the surface voids, and firmly bind the loose material in place. Screenings used in correcting segregated surface areas will be measured and paid for as base material. Type 5 and Type 7 aggregate bases are intended to provide some drainage and shall not be segregated. Trimmed Type 5 and 7 aggregate base may not be reused until the material is verified as meeting the required specifications. Base material contaminated to the extent that the material no longer complies with the specifications shall be removed and replaced with satisfactory material at the contractor's expense.
304.3.4.2 Type 1 aggregate base used for shoulders shall be compacted to a minimum 95 percent of standard maximum density. Type 1 aggregate base used on other than shoulders shall be compacted to no less than standard maximum density. Type 5 aggregate base under both roadway and shoulders shall be compacted to a minimum 95 percent of standard maximum density. The Standard Compaction Test

will be conducted in accordance with AASHTO T 99, Method C. Field density will be determined in accordance with AASHTO T 191 or AASHTO T 310, Direct Transmission, for wet density. The volume of the test hole may be reduced as necessary to accommodate available testing equipment. If nuclear density test methods are used, moisture content will be determined in accordance with AASHTO T 310, except a moisture correction factor will be determined for each aggregate in accordance with MoDOT Test Method TM 35. In lieu of the density requirements for Type 1 aggregate base used for shoulders with thicknesses less than 4 inches, the aggregate shall be compacted by a minimum of three complete coverages with a 5 ton roller. Rolling shall be continued until there is no visible evidence of further consolidation.

304.3.4.3 Type 7 aggregate base under both roadway and shoulders shall be compacted to achieve an average dynamic cone penetration index value through the base lift thickness less than or equal to 0.4 inches per blow, as determined by a standard dynamic cone penetrometer (DCP) device with a 17.6 lb hammer meeting the requirements of ASTM D6951.

304.3.4.3.1 Water shall be applied to the Type 7 base material during the mixing and spreading operations so that at the time of compaction the moisture content is not less than 5 percent of the dry weight.

304.3.4.3.2 Type 7 base shall be tested with the DCP within 24 hours of placement and final compaction.

304.3.4.4 If at any time the compacted aggregate base or subgrade becomes unstable, the contractor, at the contractor's expense, shall restore the earth subgrade and the aggregate base to the required grade, cross section and density.

304.3.5 Substitutions for Aggregate Base. If available, the contractor may substitute bituminous pavement cold millings or crushed recycled concrete in lieu of aggregate base for any temporary surface, regardless of the type or thickness of aggregate shown on the plans. If this option is exercised, the contractor shall notify the engineer at least two weeks prior to using the millings or recycled concrete, and shall identify the location from where the millings or concrete will be removed. The millings or recycled concrete shall be installed to the same dimensions shown on the plans for the aggregate base. Millings or recycled concrete shall be placed in maximum 4-inch lifts, and each lift shall be compacted by a minimum of three passes with a 10-ton roller.

304.3.6 Maintenance. The contractor shall maintain, at the contractor’s expense, the required density and surface condition of any portion of the completed aggregate base until either the prime coat or a succeeding course or pavement is placed. If a prime coat is specified in the contract, the contractor will be required to apply the prime coat on any completed portion of the aggregate base as soon as practical, or as otherwise specified. The contractor will not be permitted to apply prime if the moisture in the top 2 inches of the Type 1 or 5 aggregate base exceeds the higher of either (1) the average of the optimum moisture as determined by the Standard Compaction Test and the absorption of the plus No. 4 fraction, or (2) two-thirds of the optimum moisture as determined by the Standard Compaction Test.

304.4 Quality Control/Quality Assurance (QC/QA).

304.4.1 Quality Control. The contractor shall control operations to ensure the aggregate base, in place, meets the specified requirements for density, thickness, gradation, deleterious, and plasticity index. Tests shall be taken at random locations designated by the engineer at the following frequency:

Tested Property	Test Method	Contractor Frequency	Engineer Frequency
Density	AASHTO T 191 or AASHTO T 310	1 per 1000 tons, minimum of 1 per day	1 per 4,000 tons, minimum of 1 per project
Dynamic Cone Penetrometer Index Value (for Type 7 base)	ASTM D6951	1 per 1000 tons, minimum of 1 per day	1 per 4,000 tons, minimum of 1 per project
Thickness	Applicable method meeting engineer’s approval	1 per 1000 tons, minimum of 1 per day	1 per 4,000 tons, minimum of 1 per project
Gradation and Deleterious Material[a]	AASHTO T 11, AASHTO T 27 and MoDOT Test Method TM 71	1 per 2000 tons, minimum of 1 per day[b]	1 per 8,000 tons, minimum of 1 per project

Plasticity Index[a]	AASHTO T 89 and AASHTO T 90	1 per 10,000 tons, minimum of 1 per project	1 per 40,000 tons, minimum of 1 per project

[a]Sampled at point of delivery, prior to rolling.

[b]When production for a week is anticipated to be 1,000 tons or less, the contractor may test the material at a frequency of 1 per 250 tons or 1 per week, whichever occurs first.

304.4.1.1 The contractor shall provide copies of the test results, including all raw data, to the engineer the next business day following testing or sampling.

304.4.1.2 The contractor or the contractor's representative shall also determine the standard maximum dry density and the optimum moisture content for Type 1 and 5 base material and the dry weight for Type 7 base material and supply all test data to the engineer.

304.4.1.3 When density or DCP index value tests are less than specified or when thickness measurements indicate the thickness is deficient by more than 1/2 inch from the plan thickness, additional measurements will be taken at 100-foot intervals parallel to centerline ahead and behind the tested location until the extent of the deficiency has been determined. Each measurement will be assumed as representative of the base thickness for a distance extending one-half the distance to the next measurement, measured along centerline, or in the case of a beginning or ending measurement, the distance will extend to the end of the base section. Any deficient areas shall be corrected by reworking or adding material within the limits of the deficiency.

304.4.1.4 When two consecutive tests for gradation, deleterious material, or plasticity index do not meet the specification limits, the material shall be removed beginning at the point where the first test was conducted.

304.4.1.5 The contractor shall retain the untested portion of the plasticity index, gradation and deleterious sample for the engineer's use.

304.4.2 Quality Assurance. The contractor's QC test results and the engineer's QA test results shall meet the specifications and the following. For Type 1 and 5 base the contractor's compaction standard tests shall compare within 3.0 pounds of the maximum density of the MoDOT determined compaction standard. For Type 7 base the contractor's average DCP penetration index shall compare within 0.1 inches per blow of the MoDOT determined average penetration index. For retained samples, the contractor's test results and the engineer's test results shall compare within the following limits:

(a) The total deleterious material shall be within 2.0 percentage points.

(b) The plasticity index shall be within 2.

(c) The gradation test results shall compare within the following limits:

Sieve	Tolerance (%)
1-inch	± 6.0
1/2-inch	± 6.0
No. 4	± 6.0
No. 30	± 4.0
No. 200	± 3.0

304.4.3 Small Quantities. Small quantities are less than 50 ton, and will apply to individual projects, individual projects in combination contracts or projects with short discontinuous sections. The following acceptance procedures shall be used:

(a) QC/QA tests for gradation, deleterious material, plasticity index, density and DCP index will not berequired.

(b) Each list will be compacted by a minimum of three complete coverages with a 5-ton roller untilthere is no visible evidence of further consolidation.

(c) Acceptance will be based on visual inspection of each compacted lift by the engineer.

In lieu of this section, the contractor has the option of electing in the QC Plan to use all testing frequencies in accordance with Sec 304.4.1 for each separate aggregate base course type qualifying as a small quantity.

304.5 Method of Measurement. Final measurement of the completed aggregate base course will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Measurement will include aggregate course placed under curb and gutter. Where required, measurement of aggregate base course, complete in place, will be made to the nearest square yard . Where the aggregate base course extends to the inslope of the shoulder, the pay limit of the aggregate base course will be measured from the mid-point of the sloped portion. The revision or correction will be computed and added to or deducted from the contract quantity.

304.6 Basis of Payment. The accepted quantities of aggregate base course of the thickness and type specified will be paid for at the contract unit price for each of the pay items included in the contract. Payment will be considered full compensation for water used in performing this work. When bituminous pavement cold millings or recycled crushed concrete are substituted for aggregate base, payment will be made for the aggregate base quantity provided in the plans, regardless of whether millings, recycled crushed concrete or the aggregate base is used. Payment will be considered full compensation for hauling of millings, cold milling operations, and all other material or labor necessary to substitute bituminous pavement millings for aggregate base.

SECTION 1007
AGGREGATE FOR BASE

1007.1 Scope. This specification covers aggregate to be used for base.

1007.2 Type 1 Aggregate.

1007.2.1 Type 1 aggregate for base shall consist of crushed stone, sand and gravel or reclaimed asphalt or concrete. The aggregate shall not contain more than 15 percent deleterious rock and shale. The fraction passing No. 40 sieve shall have a maximum plasticity index of six. Any sand, silt and clay and any deleterious rock and shale shall be uniformly distributed throughout the material.

1007.2.2 The aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1-inch	100
Passing 1/2-inch	60-90
Passing No. 4	35-60
Passing No. 30	10-35

1007.3 Type 5 Aggregate.

1007.3.1 Type 5 aggregate for base shall consist of crushed stone, sand and gravel or reclaimed asphalt or concrete. The aggregate shall not contain more than 15 percent deleterious rock and shale. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt and clay, and any deleterious rock and shale shall be uniformly distributed throughout the material.

1007.3.2 Type 5 aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1-inch	100
Passing 1/2-inch	60-90

Passing No. 4	35-60
Passing No. 30	10-35
Passing No. 200	0-15

1007.4 Type 7 Aggregate.

1007.4.1 Type 7 aggregate for base shall consist of crushed stone, sand and gravel, or reclaimed asphalt or concrete. The aggregate shall not contain more than 15 percent deleterious rock and shale. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt and clay, and any deleterious rock and shale shall be uniformly distributed throughout the material.
1007.4.2 Type 7 aggregate shall be in accordance with the following gradation requirements:

Sieve	Percent by Weight
Passing 1 1/2-inch	100
Passing 1-inch	70-100
Passing No. 8	15-50
Passing No. 200	0-12

END OF SECTION 321123

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide bituminous concrete pavement consisting of and aggregate or bituminous base course, binder course(s), and bituminous concrete surface course on a prepared subbase and pavement markings where shown on the Drawings, and as specified herein.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 013219.

B. If requested by the Architect/Engineer (A/E), within 15 calendar days after the Contractor has received the Owner's Notice Award, submit:

1. Bituminous Mix Designs as applicable for:

   a. Bituminous Base Course.
   b. Bituminous Binder Course.
   c. Bituminous Surface Course.

2. Certifications of material compliance for:

   a. Aggregate base Course.
   b. Traffic Paint.

1.3 REFERENCES

A. Standard Specifications for Missouri Department of Transportation, 2024 herein noted as the Standard Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextile Fabric: Consisting of woven or non-woven filaments of polypropylene, polyester or polyethylene meeting the following minimums:

1. Grab tensile Strength (lbs): 200, ASTM D 4632.
2. Elongation (%): 50, ASTM D 4632.
3. Trapezoidal Tear Strength (lbs): 75, ASTM D 4533.

B. Aggregate Base Course:

1. Section 1007 – Type 5. (see specification 321123 Aggregate Base Courses)

C. Bituminous Base Course:

1. Section 1015 – BP – 1, PG 64-22.

D. Bituminous Binder Course:

1. Section 1015 – BP – 1, PG 64-22.

E. Bituminous Surface Course:

1. Section 1015 – BP – 2, PG 64-22.

F. Prime Coat:

1. Section 1015 – MC – 30.

G. Wheel Stops: Precast, air-entrained concrete, 3500-psi minimum compressive strength, 5-1/2 inches high by 7 inches wide by 84 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

H. Traffic (Jersey) Barriers: Precast segmental barriers (8 foot long) commonly used for traffic control, with anchoring slots or pins hole to secure in place.

I. Marking paint shall be a quality paint specifically manufactured for pavement marking applications. The A/E shall approve the manufacturer and select colors from standard colors of the manufacturer.

PART 3 - EXECUTION

3.1 FABRIC

A. Geotextile fabric when specified shall be placed on the prepared subbase prior to placement of the aggregate of bituminous base course. Fabric of insufficient width or length to fully cover the specified area shall be lapped or sown. Minimum lap shall be 12” and minimum sewn lap shall be 4”.

B. Placement of the base course on the fabric shall be accomplished in a manner as to prevent tearing or shoving of the material. Fabric damaged shall be repaired or replaced prior to placement of the base course.

3.2 AGGREGATE

A. General:The aggregate shall be uniform in gradation. The base course shall be constructed in layers not more than four (4) inches thick when compacted, except that if tests indicate that the desired results are being obtained, the compacted thickness of any layer may be increased to a maximum of eight (8) inches. When placed, it shall be free from segregation and shall require minimum blading or manipulation. Immediately after the material has been placed, it shall be compacted with a tamping roller, a vibratory machine or combination of the two.

B. Compaction: Before the aggregate is deposited on the subgrade, it shall contain the amount of moisture required for compaction. The granular material shall be compacted to not less than 98 percent of the Standard Laboratory Density, determined in accordance with ASTM D 698 (Standard Proctor Density). If test indicate that the base course does not comply with the density requirements, additional wetting, if necessary, and rolling will be required until the density is obtained. Moisture shall be added to the material during compaction only when it is necessary to increase the percentage of moisture to obtain the required density.

C. Staging: The aggregate base shall initially be placed and compacted to 90% of the design thickness shown on the Drawings. The remaining 10% of the aggregate base and final finishing shall be completed after the curbs and driveways are installed. The final surface shall be within + or - 0.5".

D. Proof roll: After the Contractor has finish graded the base course, the base shall be proof rolled with a tandem axle truck loaded with a minimum gross weight of 40,000 lbs. Any significant deflections that occur during the proof rolling shall be immediately repaired and retested.

3.3 BITUMINOUS PRIME AND TACK COAT

A. The prime coat shall be applied in accordance with Section 408. Prime Coat application rates shall be 0.4 gal/sy on aggregate bases and Tack Coat application rate 0.10 gal/sy on concrete brick and bituminous bases. A sand coat shall be applied following the prime application when the area being primed is open to traffic.

3.4 BITUMINOUS BINDER AND SURFACE COURSES

A. The bituminous binder and surface courses shall in general be constructed in compliance with Section 401 of the MoDOT Standard Specifications.

3.5 FIELD QUALITY CONTROL

A. The **Owner** shall provide testing services of an independent testing firm and/or 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. Field density/moisture tests (ASTM D2922, D2950 and D3017):

    a. Aggregate Base: 1 per 5000 sq ft.
    b. Bituminous Pavement:1 per 5000 sq ft per lift.

3.6 PAVEMENT MARKINGS

A. Preparation: The pavement surface shall be dry and free of dirt or grease. Clean if necessary.

B. Installation: Paint shall not be applied at air temperatures below 40 ° F unless approved by the A/E. Two (2) coats of paint shall be applied at a minimum thickness of 16 mils. Glass beads

shall be applied to all traffic control markings other than curbs, parking stall lines and cross hatched areas. Pavement marking words and symbols shall be as detailed in the Drawings.

PART 4 - APPENDIX

4.1 MODOT standard specifications referenced by this document follow, and are removed from "Missouri Standard Specifications for Highway Construction", 2025 Third Edition, January 2026.

SECTION 401
PLANT MIX BITUMINOUS BASE AND PAVEMENT

401.1 Description. This work shall consist of a bituminous mixture placed, spread and compacted as shown on the plans or as directed by the engineer.

401.2 Material.

401.2.1 The grade of asphalt binder will be specified in the contract. When the plasticity index on individual aggregate fractions with 10 percent or more passing the No. 30 sieve exceeds 3, a moisture susceptibility test shall be required in accordance with Sec 401.4.5 during the mix design process. If the plasticity index exceeds that of the material approved for the mix design, additional testing may be required. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Coarse Aggregate	1004.2
Fine Aggregate	1002.3
Mineral Filler	1002.4
Hydrated Lime	1002.5
Asphalt Binder, Performance Graded (PG)	1015

401.2.2 Reclaimed Asphalt. Reclaimed Asphalt may be obtained from Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS). The asphalt binder content of recycled asphalt materials shall be determined in accordance with AASHTO T 164, ASTM D 2172 or other approved method of solvent extraction. A correction factor for use during production may be determined for binder ignition by burning a sample in accordance with AASHTO T 308 and subtracting from the binder content determined by extraction.
The use of reclaimed asphalt shall be limited to one of the following options with the exception of bituminous base. For bituminous base the limits specified may be increased according to the recycled materials used as follows; 10% for RAP only, 5% for RAS only and 10% for the appropriate RAP and RAS combination.

Binder	Percent Effective Virgin Binder Replacement		
	RAP	RAS	RAP and RAS combination
Contract Grade Virgin Binder shall be used	0 - 20	0 -10	RAP + (2*RAS) ≤ 20
PG 58-28 Virgin Binder shall be required[a]	21 - 30	11 - 15	20 < RAP + (2*RAS) ≤ 30
Blend Chart[b]	0 - 100	N/A	N/A
Extraction and Grading of Binder from final Mixture[c]	0 - 100		

[a]Contract grades within recycling limits specified in the table shall have a high temperature grade of PG58 or higher and a low temperature grade meeting a PG-28 (Ex. Contract grade PG 64-22; virgin binder could be either PG 58-28 or PG 64-28. Contract grade PG 58-28H; virgin binder remains at PG 58-28H or PG 58-28.). The Pressure Aging Vessel (PAV) test temperature (AASHTO M320) shall be tested at 19° C, regardless of the high temperature grade of the selected virgin binder.
[b]Testing in accordance with AASHTO M323 including raw data shall be included with the mix design which demonstrates that the grade of the combine mixture meets the contract requirements.
[c]Testing in accordance with either AASHTO T319, or AASHTO T164 and R59 along with grading in accordance with AASHTO M320 including raw data shall be included with the mix design which demonstrates that the grade of the combine mixture and rejuvenator, if applicable, meets the contract requirements. **401.2.2.1 Reclaimed Asphalt Pavement.** Reclaimed Asphalt Pavement (RAP) may be used in any Sec 401, Plant Mix Bituminous Base and Pavement. All RAP material, except as noted below, shall be tested in accordance with AASHTO T 327, Method of Resistance of Coarse Aggregate Degradation by Abrasion in the Micro-Deval Apparatus. Aggregate shall have the asphalt coating removed either by extraction or binder ignition during production. The material shall be tested in the Micro-Deval apparatus at a frequency of once per 1500 tons. The percent loss shall not exceed the Micro-Deval loss of the combined virgin material by more than five percent. Micro-Deval testing will be waived for RAP material obtained from MoDOT roadways. All RAP material shall be in accordance with Sec 1002 for deleterious and other foreign material. The aggregate specific gravity shall be determined by performing AASHTO T 209 in accordance with Sec 403.19.3.1.2 and calculating the G_{se} to which a 0.98 correction factor will be applied in order to determine G_{sb} as follows:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

RAP G_{sb} = RAP G_{se} X 0.98

See Sec 401.4.4.1 for mixes containing more than 40% effective binder replacement from reclaimed asphalt.
401.2.2.2 Reclaimed Asphalt Shingles. Reclaimed Asphalt Shingles (RAS) may be used in any mixture specified to use PG 64-22 in accordance with AASHTO PP 53. In addition, shingles shall be ground to 3/8-inch minus. Waste, manufacturer or new, shingles shall be essential free of deleterious materials. Post-consumer RAS shall not contain more than 1.5 percent wood by weight or more than 3.0 percent total deleterious by weight. Post-consumer RAS shall be certified to contain less than the maximum allowable amount of asbestos as defined by national or local standards. The bulk specific gravity of RAS used in the job mix formula shall be 2.600.

RAS G_{sb} = 2.600

See Sec 401.4.4.1 for mixes containing more than 40% effective binder replacement from reclaimed asphalt.
The gradation of the aggregate may be determined by solvent extraction of the binder or using the following as a standard gradation:

Shingle Aggregate Gradation	
Sieve Size	**Percent Passing by Weight**
3/8 in.	100
No. 4	95
No. 8	85
No. 16	70
No. 30	50

No. 50	45
No. 100	35
No. 200	25

401.2.2.3 Rejuvenators. Rejuvenators may be used in any asphalt mixture containing recycled material. When a rejuvenator is used for the purpose of softening the binder grade, the requirements for the Extraction and Grading of Binder from Final Mixture option in Sec 401.2.2 must be satisfied.

401.3 Composition of Mixtures. Aggregate sources shall be from the specific ledge or combination of ledges within a quarry, or processed aggregate from a particular product, as submitted in the mix design. The total aggregate prior to mixing with asphalt binder shall be in accordance with the following gradation requirements:

Sieve Size	**Percent Passing by Weight**			
	Base	**BP-1**	**BP-2**	**BP-3**
1 inch	100	100	100	100
3/4 inch	85-100	100	100	100
1/2 inch	60-90	85-100	95-100	100
3/8 inch	---	---	---	100
No. 4	35-65	50-70	60-90	90-100
No. 8	25-50	30-55	40-70	---
No. 16	---	---	---	30-60
No. 30	10-35	10-30	15-35	---
No. 200	4-12	5-12	5-12	7-12

401.4 Job Mix Formula. At least 30 days prior to placing any mixture on the project, the contractor shall submit a mix design for verification and approval by Construction and Materials. The mixture shall be designed in accordance with Asphalt Institute Publication MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types. The mixture shall be compacted and tested at a minimum of three asphalt contents separated by a maximum of 0.5 percent in accordance with AASHTO T 245, except as herein noted. The test method shall be modified by short-term aging the specimens in accordance with AASHTO R 30. A detailed description of the mix design process shall be included with the job mix formula. Representative samples of each ingredient for the mixture shall be submitted with the mix design. Aggregate fractions shall be in accordance with the same proportions as the proposed job mix formula. A minimum of 150 pounds will be required for any individual fraction. The amount of each ingredient submitted shall be as follows for each mix design to be verified:

Ingredient	**Minimum Amount**
Aggregate	300 lbs
Hydrated Lime, Mineral Filler and/or Baghouse Fines	20 lbs
Asphalt Binder	10 gal.

401.4.1 Mixture Design. Laboratories that participate and achieve a score of 3 or greater in the AASHTO proficiency sample program for T 11, T 27, T 84, T 85, T 166, T 209, T 308 and T 245 or T 312 will have the mixture verifi-

cation process waived. The mix design shall be submitted to Construction and Materials for approval at least seven days prior to mixture production.

401.4.2 Required Information. The mix design shall include raw data from the design process and shall contain the following information:

(a) All possible sources intended for use, and grade and specific gravity of asphalt binder.

(b) Source, type (formation, etc.), ledge number(s) if applicable, gradation, and percent chert of eachaggregate fraction.

(c) Plasticity index of each aggregate fraction which has 10 percent or more passing the No. 30 sieve.

(d) Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance withAASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate, including all raw data, or in accordance with TM 81.

(e) Specific gravity of hydrated lime, mineral filler or baghouse fines, if used, in accordance withAASHTO T 100.

(f) Percentage of each aggregate component.

(g) Combined gradation of the job mix.

(h) Percent of asphalt binder, by weight, based on the total mixture.

(i) Bulk specific gravity (G_{mb}) by AASHTO T 166, Method A of a laboratory compacted mixture.

(j) Percent air voids (V_a) of the laboratory compacted specimen.

(k) Voids in the mineral aggregate (VMA) and voids in the mineral aggregate filled with asphalt binder(VFA).

(l) Theoretical maximum specific gravity (G_{mm}) as determined by AASHTO T 209 in accordance with Sec 403.19.3 after the sample has been short-term aged in accordance with AASHTO R 30.

(m) Mixing temperature and molding temperature.

(n) Bulk specific gravity (G_{mb}) of the combined aggregate.

(o) Percent deleterious content of the combine aggregate.

(p) Baghouse fines added for design. Provide the combine gradation with and without the baghousepercentage.

401.4.3 Mixture Approval. No mixture will be accepted for use until the job mix formula for the project is approved by Construction and Materials. The job mix formula approved for each mixture shall be in effect until modified in writing by the engineer. When unsatisfactory results or other conditions occur, or should a source of material be changed, a new job mix formula may be required. In lieu of a new laboratory design, mixtures requiring adjustment beyond the limits allowed in Sec 401.8.2 may be designed in the field based on characteristics of plant-produced mixture in accordance with Sec 401 and verified by Construction and Materials, which may require new aggregate characteristics.

401.4.4 Mixture Characteristics.

401.4.4.1 Base, BP-1, BP-2 and BP-3 mixtures shall have the following properties, when tested in accordance with AASHTO T 245 or AASHTO T 312. The number of blows with the compaction hammer shall be 35 or the number of gyrations shall be 35 with the gyratory compactor. BP-1 and BP-2 mixtures shall have between 60 and 80 percent of the VMA filled with asphalt binder and dust to effective binder ratio of 0.8 to 1.6. BP-3 mixtures shall be compacted with the gyratory compactor to 35 gyrations and shall have a minimum 75 percent of the VMA filled with asphalt binder and dust to effective binder ratio of 0.9 to 2.0.

Mix Type	Percent Air Voids	AASHTO T 245 Stability lb	Voids in Mineral Aggregate (VMA)[b]
BB	3.5	750	13.0[a]
BP-1	3.5	750	13.5
BP-2	3.5	750	14.0
BP-3	3.5	750	15.0

[a]Bituminous base mixtures that would require 12.0 percent VMA following Asphalt Institute MS-2 will have a minimum 12.0 percent requirement.
[b]If the effective virgin binder replacement from RAP, RAS, or any combination of RAP and RAS is greater than 40 percent; then the minimum VMA required shall be increased by 0.5.

401.4.4.2 When specified in the contract as BP-3NC, BP-3 mixtures containing limestone aggregate shall contain a minimum amount of non-carbonate aggregate as shown in the table below, or the aggregate blend shall have an acid-insoluble residue (A.I.R.), MoDOT Test Method TM 76, meeting the criteria of crushed noncarbonate material. The A.I.R. shall be determined on the minus No. 4 sieve. Non-carbonate aggregate shall have an A.I.R. of at least 85 percent insoluble residue.

Aggregate	Minimum Non-Carbonate by Volume
Limestone	20% Minus No. 4
Dolomite	No Requirement

401.4.5 Moisture Susceptibility. When required moisture susceptibility shall be tested in accordance with AASHTO T 283. The mixture shall have a tensile strength ratio (TSR) of 70 percent or greater when compacted to 3.7 inches with 7 ± 0.5 percent air voids. An approved anti-strip additive may be added to increase retained strength to a passing level. When testing is required by Sec 401.2.1 or Sec 401.9, the mixture shall be tested during production in accordance with Sec 403.19.

401.4.6 Time Limit. A mix design may be transferred to other projects for a period of three years from the original approval date provided satisfactory results are obtained during production and placement.

401.5 Gradation and Deleterious Content Control. The engineer shall be notified as soon as possible, but no later than 24 hours if a change is made to the cold feed settings, hot bin settings or the binder content. The contractor shall determine the mixture gradation at the frequency stated in Sec 401.8.1. The mixture gradation may be determined directly by using residual aggregate from the binder ignition process or by mathematical combination of the cold feed and recycled materials gradations. When the mathematical combination method is used, the RAS gradation shall be from the JMF and RAP gradation from the ignition or extraction residual aggregate. Mixtures as produced shall be subject to the following tolerances and controls:

(a) The maximum variations from the approved job-mix formula shall be within the tolerances as shown in the table below:

Sieve Size	Percent Passing by Weight	
	Tolerance	Action Limit
No. 8[a]	± 5.0	± 10.0
No. 200	± 2.0	± 4.0

[a] Use No. 16 sieve for BP-3

(b) The deleterious content of the material retained on the No. 4 sieve shall not exceed the limitsspecified in Sec 1004.2.

(c) The quantity of asphalt binder introduced into the mixer shall be the quantity specified in the jobmix formula. No changes shall be made to the quantity of asphalt binder without written approval from the engi-

neer. The quantity of asphalt binder determined by tests on the final mixture shall not vary by more than -0.3 to + 0.5 percent from the job-mix formula.

401.5.1 Sample Location. The gradations of the total aggregate will be determined from samples taken from the hot bins on batch-type plants or continuous mixing plants or from the composite cold feed belt on drum mix plants. The deleterious content of the total aggregate shall be determined from samples taken from the composite cold feed belt. When required, samples for plasticity index shall be taken from the stockpile. Aggregate samples shall be taken in accordance with AASHTO R 90. The RAP shall be sampled from the RAP feeding system on the asphalt plant. Samples for asphalt content determination may be taken at the plant.

401.5.2 Substitutions. At the option of the contractor and at no cost to the Commission, the contractor may use a Sec 401 mixture with a smaller nominal maximum size aggregate or an approved Sec 403 mixture, design level C, E, or F with the same or smaller nominal maximum size aggregate in lieu of any Sec 401 mixture. When a Sec 403 mixture is substituted, the layer thickness requirements of Sec 403 will apply. The gradation, asphalt content, deleterious, and density acceptance of the substituted mixture during production will be in accordance with Sec 401.

401.5.3 Commercial Mixture. If specified in the contract that an approved commercial mixture may be used, the contractor shall, at least seven days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture proposed to be furnished. The statement shall include:

(a) The types and sources of aggregate, percentage range of each, and range of combined gradation.

(b) The percent and grade of asphalt binder.

(c) The mixing time and range of mixture temperature.

The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. It will not be necessary for the plant to meet the requirements of Sec 404. A field laboratory will not be required. If the proposed mixture and plant are approved by the engineer, the component material and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall furnish with the first truckload of each day's production, a certification that the material and mixture delivered are in conformance with the approved mixture. Upon completion of the work, a plant certification shall be furnished by the supplier for the total quantity delivered. The mixture shall be transported, placed and compacted in accordance with Sec 401.7. Without specific contract designation, an approved commercial mixture may be used in lieu of plant mix bituminous pavement or base course mixtures for work that is considered temporary construction and is to be maintained at the contractor's expense. Temporary construction will be defined as work that is to be removed prior to completion of the contract.

401.5.4 Moisture Content. The bituminous mixture, when sampled and tested in accordance with AASHTO T 329, shall contain no more than 0.5 percent moisture by weight of the mixture.

401.5.5 Contamination. The bituminous mixture shall not be contaminated with deleterious agents such as unburned fuel, objectionable fuel residue or any other material not inherent in the job mix formula.

401.6 Field Laboratory. The contractor shall provide a Type 3 field laboratory in accordance with Sec 601. The contractor may use the equipment provided in the Type 3 laboratory as long as adequate space is provided for the engineer's work.

401.7 Construction Requirements.

401.7.1 Weather Limitations. No mixture shall be placed on any wet or frozen surface. No mixture shall be placed when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 40 F. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

401.7.2 Bituminous Mixing Plants. Bituminous mixing plants and preparation of material and mixtures shall be in accordance with Sec 404.

401.7.3 Subgrade or Surface Preparation. The subgrade upon which the bituminous mixture is to be placed shall be prepared in accordance with Sec 209 and primed as specified in the contract in accordance with Sec 408, as applicable. All material requirements of a tacked surface shall be in accordance with Sec 407.

401.7.3.1 Base Widening. For base widening work, the bottom of the trench shall be compacted until further consolidation is not visually evident, by use of a trench roller having a weight of no less than 300 psi of width of rear roller, or by mechanical tampers or other methods approved by the engineer. Suitable excavated material may be used in shouldering operations. On the outside of curves, the

design depth of trench at the beginning of the superelevation transition shall be varied gradually to the minimum depth at the end of the superelevation transition. Slight transitioning of the width of the base widening will be necessary to permit the indicated angle of repose or shear angle outside of the ultimate edge of surface. The bottom of the trench shall in no case be less than 3 inches below the surface of the existing pavement. All surplus excavated material shall be disposed of by the contractor in areas to be secured by the contractor beyond the right of way limits. An acceptable written agreement with the property owner on whose property the material is placed shall be submitted to the engineer.

401.7.3.2 **Application of Prime or Tack.** Application of prime or tack shall be in accordance with Sec 403.12.

401.7.4 **Hauling Equipment.** Trucks used for hauling bituminous mixtures shall be in accordance with Sec 404.

401.7.5 **Spreading.** The base course, tacked or primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign matter prior to spreading the bituminous mixture. The mixture shall be spread in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. When placing multiple layers with varying thicknesses, the thicker layer shall be placed first.

401.7.5.1 **Irregularities.** The mixture shall be spread without tearing the surface and struck off such that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with a suitable mixture at the contractor's expense. The outside edge alignment shall be uniform.

Irregularities shall be corrected by adding or removing mixture before compacting. In situations where there is a dispute in the existence of segregation, the area in question will be tested in accordance with MoDOT Test Method TM 75. Mixture production shall immediately cease if either criteria of MoDOT Test Method TM 75 fail. Segregated mixtures shall be removed and replaced to the limits determined by the engineer.

401.7.5.2 **Leveling Course.** If required by the contract, a leveling course consisting of a layer of variable thickness shall be spread to the desired grade and cross section to eliminate irregularities in the existing surface. Spot-leveling operations over small areas, with feather-edging at high points and ends of spot areas, may be required prior to placing the leveling course. Rigid control of the placement thickness of the leveling course will be required. The mixture shall be practically free from segregation.

401.7.5.3 **Base Widening.** The specified total thickness of base widening shall be completed to the adjacent traveled way elevation as shown on the plans. Additional thickness of base widening may be placed as required prior to coldmilling, at the contractor's expense, and shall subsequently be coldmilled to the same elevation as the traveled way, if conducive to expedite operations. On base-widening work, a succeeding layer of bituminous mixture may be placed the same day as the previous layer, if it can be shown that the desired results are being obtained. On small areas, and on areas that are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods if permitted by the engineer. At least one lane of the existing pavement and the adjacent shoulder shall be kept open to traffic at all times during construction, except for short intervals when the movement of the contractor's equipment will seriously hinder the flow of traffic. Intervals during which the contractor will be allowed to halt traffic shall be as designated by the engineer. The contractor shall not open more trenches ahead of the first layer of the base widening than is necessary for placing that layer in one half a day's operations. The first layer of the base widening shall not be placed for a greater distance ahead of the second layer than is necessary for placing the second layer in one half a day's operations. The second layer shall not be placed for a greater distance ahead of the final layer than is necessary for placing the final layer in one day's operation. Any changes in these lengths shall be made only with written permission from the engineer.

401.7.5.4 **Edge Differential.** For roadways constructed under traffic, no pavement edge differential shall be left in place for more than seven days, unless approved by the engineer.

401.7.6 **Joints.** The minimum density of all traveled way pavement within 8 inches of an unconfined longitudinal joint, shall be no less than 2.0 percent below the specified density. The cores taken to evaluate this area shall be centered 6 inches from the unconfined longitudinal joint near the centerline, and centered 12 inches from the unconfined longitudinal joint near the shoulder. If no deficient cores are found in the first 25 percent of production, the established rolling procedure may be used, at the direction of the engineer, in lieu of density tests provided no changes in the material, typical location or temperatures are made. Pay adjustments due to unconfined longitudinal joint density shall apply to the full width of the lane paved. Adjustments due to joint density shall apply to the day's production from which the cores are obtained. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the layer. When a transverse vertical edge is to be left in place and opened to traffic, a temporary depth transition shall be constructed as approved by the engineer. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately 6 inches. The joints in the final surface layer shall be at the lane lines of the traveled way, except that the placement width shall be adjusted such that pavement marking shall not fall on a longitudinal joint. Each side of the joint shall be flush and along true lines.

401.7.7 **Surfaced Approaches.** At locations designated in the contract or as specified by the engineer, approaches shall be primed in accordance with Sec 408 and surfaced with a plant mix bituminous mixture. The bituminous surface shall be placed as shown on the plans or as directed by the engineer. Approaches shall not be surfaced before the surface course adjacent to the entrance is completed. No direct payment will be made for any work required to condition and prepare the subgrade on the approaches.

401.7.8 **Compaction.** The compacted mixture shall have a minimum density of 92 percent of the theoretical maximum specific gravity. Density will be determined by the direct transmission nuclear method in accordance with MoDOT Test Method TM 41 or by a specific gravity method. When the contractor elects to place a lift of mixture greater than six times the nominal maximum aggregate size, cores shall be cut in half and the density of each half determined separately. In lieu of density requirements, mixtures used for wedging, transitions, existing shoulder overlays, new shoulders constructed on a sub-grade or base that does not specify density control, temporary bypasses to be maintained at the expense of the contractor, and areas where a commercial mixture is used shall be thoroughly compacted by at least three complete coverage's over the entire area with either a pneumatic tire roller weighing no less than 10 tons, a tandem-type steel wheel roller weighing no less than 10 tons or an approved vibratory roller. Rolling shall be performed at proper time intervals on each layer and shall be continued until there is no visible evidence of further consolidation.

401.8 Quality Control. The contractor shall maintain equipment and qualified personnel to perform QC field inspection, sampling and testing in accordance with applicable portions of Sec 403. A QC Plan will not be required. A proposed third party for dispute resolution shall be included with the mix design submittal.

401.8.1 **Mixture Testing.** The contractor shall randomly test the mixture within the following frequencies. The gradation and the asphalt content shall be determined at least once every 1,000 tons of production or a minimum of once per day. Deleterious content shall be determined once per 5,000 tons unless quality concerns dictate more frequent testing as directed by the engineer. Gradation and asphalt content of RAP shall be determined once every 10,000 tons of production. If RAP is used and AASHTO T 308 is used to determine the asphalt content, the binder ignition oven shall be calibrated in accordance with MoDOT Test Method TM 77. At the engineer's discretion, testing may be waived when production does not exceed 200 tons per day. The contractor shall certify the proper proportions of a previously proven mixture were used.

401.8.2 **Failing Test.** If a, deleterious content, or asphalt content test result falls outside of the specification tolerances, a review or adjustment of the plant settings and production shall be made and another sample shall be immediately taken. If the second test falls outside of the specification tolerances, production shall be immediately ceased until the mixture can be brought back into specification. If a gradation test falls between the Tolerance and Action Limits, adjustments to plant shall be made and another gradation shall be taken immediately. Plant production for the following day shall not resume until the mixture is brought back into specification when the final gradation for the day is not within tolerance. If a gradation test falls outside the Action Limit, production shall cease until the mixture is brought back into specification.

401.8.3 **Retained Samples.** One half of the contractor's sample for gradation, deleterious content, and asphalt content and all cores shall be retained for the engineer. The contractor shall retain the samples for 7 days after testing has been completed and the results accepted by the engineer.

401.8.4 **Pavement Testing.**During construction, the engineer will designate as many tests as necessary to ensure that the course is being constructed of proper thickness, composition and density. Density of the roadway shall be determined by one core obtained by the contractor at a random location selected by the engineer for every 500 tons of production. The cores from each day's production will be averaged to determine acceptance. A joint density core shall be taken from the same transverse cross section as the mat core and alternate sides. The maximum theoretical density shown on the job mix formula shall be used for this determination. Minimum 4inch diameter cores, shall be taken the full depth of the layer to be tested. Cores tested by AASHTO T 166 shall be in accordance with Sec 403.19.3.1.3. The contractor shall restore the surface from which samples have been taken immediately with the mixture under production or with a cold patch mixture acceptable to the engineer.

401.8.5 **Density Adjustment.** Payment for mixture placed at or below the required minimum density will be adjusted as follows:

Field Density Percent of Maximum Theoretical Density	**Percent of Contract Unit Price**[a]
91.5 or above	100%
91.0 to 91.4, inclusive	97%
90.5 to 90.9, inclusive	94%
90.0 to 90.4, inclusive	90%
89.5 to 89.9, inclusive	80%
Below 89.5	Remove and Replace

[a]When adjustments are necessary, the lower percent of the contract unit price of either the pavement or joint density adjustment will apply.

401.9 **Quality Assurance.**Acceptance tests for gradation, deleterious content and asphalt content will be performed by the engineer at a minimum rate of one independent sample per 4 QC samples. A favorable comparison will be considered when a QA test is within the specification tolerances. An acceptance test for plasticity index will be performed at a minimum rate of one per project by the engineer on an independent sample taken during production. Initial testing will be performed the first week of production. When the plasticity index on an individual aggregate fraction is more than two percentage points above the value shown on the approved mix design, moisture susceptibility testing shall be required in accordance with Sec 401.4.5. At least once for every five days of production, a split of the contractor's sample will be tested. If the results of the split sample are not within five percent on all sieves above the No. 200, two percent on the No. 200, within the specification ranges on the deleterious content, and within 0.5 percent on the asphalt content from the contractor's results, another split sample will be taken jointly with the contractor and tested. If the second test results do not compare within the specification tolerances, production shall cease until the discrepancy is resolved. If the second test results compare within the above tolerances, production may continue. The engineer will retain one half of the plasticity index test and moisture susceptibility test for 7 days after testing is complete. Results of QA testing will be furnished to the contractor within 24 hours of obtaining the sample, with the exception of moisture susceptibility testing.

401.10 **Surface Smoothness.** The finish of the pavement surface shall be substantially free from waves or irregularities and shall be true to the established crown and grade. The pavement shall be thoroughly tested for smoothness by profiling or straightedging in accordance with Sec 610.

401.11 **Defective Mixture.** Any mixture showing an excess of bituminous material or that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with a satisfactory mixture, which shall be immediately compacted to conform to the surrounding area.

401.12 **Pavement Marking.** If the contractor's work has obliterated existing pavement marking on resurfacing projects open to through traffic, the pavement marking shall be replaced at the contractor's expense in accordance with Sec 620.

401.13 **Method of Measurement.** Measurement will be in accordance with Sec 403.

401.14 **Basis of Payment.** The accepted quantities of plant mix bituminous pavement and base course will be paid for at the contract unit price for each of the pay items included in the contract. Payment for obtaining and delivering samples of compacted mixture from the base and replacement of the surface will be made per sample at the fixed contract unit price specified in Sec 109. No direct payment will be made for QC cores, excavating the trench for base widening, or for hauling and disposing of excess excavation material.

SECTION 408
PRIME COAT

408.1 Description. This work shall consist of preparing and treating an existing surface with bituminous material in accordance with these specifications, as shown on the plans or as directed by the engineer.
408.2 Material. The type and grade of bituminous material will be specified in the contract. Liquid asphalt may be changed one grade by the engineer during construction at no change in the contract unit price. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Type RC and MC Liquid Asphalts	1015
Emulsified Asphalt	1015

408.3 Equipment. Equipment shall be in accordance with Sec 407.
408.4 Construction Requirements.

408.4.1 Preparation of Surface. The surface to be primed shall be shaped to the required grade and cross section, shall be free from all ruts, corrugations, segregated material or other irregularities, and shall be uniformly compacted by rolling. The surface shall be firm and slightly damp when primer is applied. Delays in priming may necessitate reprocessing or reshaping to provide a smooth compacted surface.
408.4.2 Application. Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. The application rate shall be as specified in the contract, or as revised by the engineer between 0.2 and 0.5 gallon per square yard. The primer shall be heated at the time of application in accordance with the limits provided in Sec 1015.
408.4.2.1 There shall be no overlapping of bituminous material. Pools of primer material remaining on the surface after the application shall be removed. As soon as the bituminous material has been absorbed by the surface and will not track, traffic may be routed onto the treated traveled way. Any damage caused to the prime coat due to the contractor's equipment or decision to allow traffic on the roadway too soon shall be primed again at the contractor's expense.
408.4.2.2 The primer shall be properly cured and the primed surface shall be cleaned of all dirt and surplus sand before the next course is placed.
408.5 Method of Measurement. Bituminous material will be measured to the nearest gallon and adjusted for temperature correction in accordance with Sec 1015.
408.6 Basis of Payment. The accepted quantities of prime coat will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for furnishing or applying any water required for dampening the surface to be primed.

SECTION 1015
BITUMINOUS MATERIAL

1015.1 Scope. This specification covers bituminous material to be used in highway construction.
1015.2 Approval of Source. The contractor shall obtain approval of the source of bituminous material from the engineer before any shipments to the work site are made.
1015.3 Sampling, Testing and Acceptance Procedures .The supplier shall certify that the bituminous material complies with the specification requirements.
1015.3.1 Certification. The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket to be available to MoDOT at the destination prior to unloading. The engineer at the source shall be furnished a copy. The bill of lading, manifest or truck ticket shall provide the following information regarding the shipment: type and grade of material, chemical additives, such as polyphosphoric acid (PPA), used in modification, specific gravity at 60 F, net gallons, consignee, truck number, identification number, weight of truck before and after loading, destination, date loaded, name and location of the source, and a certification statement. The certification statement shall be signed by an authorized representative of the supplier and shall be substantially as follows:
"This certifies that the bituminous material in this shipment is in accordance with MoDOT specifications for the grade specified and the weights (masses) shown hereon were obtained on MoDOT approved scales and are correct within the specified scale requirements."
1015.3.2 Sampling. The engineer will at random observe the sampling and testing of truck shipments and tanks, and will select representative samples of the material being supplied for testing in the field or in the Central Laboratory. When test results certified by the supplier are not representative of the material being shipped, the source approval will be withdrawn. A source may be reinstated when proof is furnished that the deficiency has been corrected and adequate controls are in effect to guarantee delivery of material meeting specifications. Sampling and test methods for asphalt shall be as follows:

Property	Method	RC	MC	PG
Sampling	AASHTO T 40	X	X	X
Water	AASHTO T 55	X	X	X
Flash Point (Tag Open Cup)	AASHTO T 79	X	X	
Flash Point (Cleveland Open Cup)	AASHTO T 48			X
Viscosity, Centistokes	AASHTO T 201	X	X	
Distillation	AASHTO T 78	X	X	
Penetration	AASHTO T 49	X	X	
Ductility	AASHTO T 51	X	X	
Solubility in Trichloroethylene	AASHTO T 44	X	X	X
Ash in Bituminous Material	AASHTO T 111			
Viscosity (Rotational)	ASTM D 4402			X

Dynamic Shear	AASHTO 315			X
Rolling Thin Film Oven Test	AASHTO T 240			X
Pressure Aging Test	AASHTO R28			X
Creep Stiffness	AASHTO T 313			X
Direct Tension	AASHTO T 314			

1015.3.3 Sampling Equipment. The supplier shall furnish the required sampling equipment and shall sample the contents of the truck under the direction of the engineer. The supplier shall keep all sampling equipment clean and in good condition. Sampling devices on truck transports will be approved provided an adequately insulated valve is used with a pipe or nipple inserted a suitable distance into the tank.

1015.3.4 Truck Log. Each truck transport shall carry a log showing types of material and the dates hauled with respect to previous shipments, or the supplier shall furnish to the engineer such information with respect to the previous load.

1015.3.5 Intermediate Storage. Intermediate storage tanks for storage and transfer of material between the refinery or terminal and the point of acceptance shall be equipped for sealing and shall be reserved exclusively for MoDOT work. Use of any material from unsealed tanks will be subject to delay until material can be sampled, tested and approved.

1015.3.6 Other Transportation. At sources from which liquid bituminous material is being accepted by certification, the applicable requirements of the foregoing sections shall be followed for shipments of material in transportation units other than trucks. The certification and all information regarding each shipment shall be furnished to the engineer at the source.

1015.3.7 Railroad Shipments. For railroad shipments from refineries where inspection is not maintained by MoDOT, the supplier shall sample each car load at the source and submit the sample promptly to the Central Laboratory. A bill of lading or identification sheet shall accompany each sample and contain the following information: car number, type and grade of material, chemical additives, such as PPA, used in modification, quantity represented, including gross gallons, temperature and net gallons at 60 F, destination of shipment, project number and consignee. A certification statement as specified in Sec 1015.3.1 shall accompany each sample. Approval of the source may be withdrawn if samples submitted are not representative of the material shipped in the car.

1015.4 Proportioning and Blending Bituminous Material Constituents. All material shall be properly proportioned and thoroughly blended in suitable tanks prior to delivery to transportation equipment, or material may be proportioned and blended by use of automatic proportioning equipment. All automatic-proportioning blenders shall meet the approval of the engineer and shall be equipped with precision instruments, including electrically interlocked motors and automatic meters.

1015.5 Application Temperatures for Bituminous Material.

Bituminous Material	**Temperature, Degrees Fahrenheit**			
	Spraying		**Mixing**	
	Min	**Max**	**Min**	**Max**
Asphalt Binder				
PG 46-28	260	325	----	----
All Other Grades	285	350	275	350
Liquid Asphalt RC-MC				
Grade				
30	70	150	50	110

70	100	180	90	140
250	150	220	130	170
800	180	260	170	210
3000	210	290	200	240
Asphalt Emulsions				
RS-1	120	140	----	----
RS-2	125	185	----	----
SS-1	120	160	70	160
SS-1h	120	160	70	160
SS-1vh	160	180	140	160
CRS-1	125	185	----	----
CRS-2	125	185	----	----
CSS-1	120	160	70	160
CSS-1h	120	160	70	160
EA-90P	130	180	----	----
CRS-2P	130	180	----	----
CHFRS-2P	130	180	----	----

[a] The minimum mixing temperature shall be lowered to 200 when a warm mix technology, as approved by the engineer, is used.

1015.5.1 Application temperatures of other grades of emulsions shall be as specified in the contract.
1015.5.2 The spraying temperature for non-modified PG 46-28 asphalt binder shall be 260 - 325 F, and for all other higher temperature non-modified performance grades, the spraying temperature shall be 285 - 350 F. The mixing and compaction temperatures for performance graded asphalt binder shall be determined by rotational viscosity testing as defined in ASTM D 4402.
1015.5.3 When material to be applied by pressure distributor is, due to refining or blending procedures, delivered at a temperature above the specified limits, the material may be applied at the higher temperature provided satisfactory application can be obtained at the specified rate and provided sufficient precaution is exercised with respect to the fire hazard.
1015.6 Measurement of Bituminous Material. Field weight or field volumetric determinations of the material actually incorporated into the work will be used for measurement of the quantity of bituminous material for payment. The volume of material supplied from intermediate storage tanks will be determined from the net weight of the material. The net weight will be determined from the gross weight of the loaded transport vehicle used to deliver the material to the project less the empty transport vehicle weight. The volume correction methods specified below will be used for determining the volume of bituminous material. Scales for determining the weight of bituminous material shall be in accordance with Sec 310.
1015.6.1 Liquid Bituminous Material and Asphalt Binder - Volumetric Determination. Measurement of the material will be based on the volume at 60 F. The volume correction factors of ASTM D 4311, Table 2, will be used for converting the material from the volume at the observed temperature to the volume at 60 F. The volume of uncalibrated distributors and tank trucks will be determined from the net weight of the material. The net weight will be determined from the gross weight of the loaded delivery vehicle less the empty delivery vehicle weight. For computing the volume in gallons from weight, the following formula will be used:

$$G = \frac{W}{SG \times 8.328}$$

where:
G = Volume in gallons at 60 F.
W = Weight of material in pounds.
SG = Specific Gravity of material at 60 F.

1015.6.2 Emulsified Asphalt. Measurement of the material will be based on the volume at 60 F using a coefficient of expansion of 0.0003 per degree F for converting the material from the volume at the observed temperature to the volume at 60 F.

SECTION 1015.10 PERFORMANCE GRADED ASPHALT BINDER.

1015.10.1 General. Performance graded asphalt binder shall be an asphalt-based binder produced from petroleum residue either with or without the addition of non-particulate organic modifiers, except Re-refined Engine Oil Bottoms (REOB) and Vacuum Tower Asphalt Extenders (VTAE) shall not be used as modifiers. The grade shall be as specified in the contract.

1015.10.2 Basis of Acceptance. Suppliers furnishing performance graded asphalt binders to MoDOT projects by certification shall be in accordance with AASHTO R 26, except as noted herein. To become pre-qualified to furnish material, a written request shall be sent to Construction and Materials, along with a copy of the supplier's QC plan. Split samples may be required. Changes in formulation, base stock or methods of manufacture of qualified performance graded binders shall be noted and may require requalification.

1015.10.2.1 Quality Control Plan Requirements. The QC plan shall be in accordance with AASHTO R 26 with the following exceptions and modifications:

(a) The plan shall be written to cover multiple terminals or shipping facilities, in addition to theprimary manufacturing facility, provided specific requirements for each location are clearly stated.

(b) The plan shall state the lot size used to designate the frequency of QC and specification compliancetesting for each performance grade to be supplied. The lot size will depend upon the method of manufacture and may be designated on a tank basis, or on a time basis in the case of binders that are blended into trucks or tanks or that are continually blended into "live" tanks.

(c) For terminals or manufacturing facilities, the minimum reduced frequency of testing for QC orspecification compliance shall be one series of tests every two weeks for "live" tanks or blenders and one series of tests every four weeks for "static" tanks that have had no material added between testing, per lot per grade of binder shipped.

(d) Quality Control testing may be used to determine that binders being shipped from terminals ormanufacturing facilities have not been contaminated, provided that such testing is shown to be of sufficient accuracy to detect contamination and to assure that material meets required specifications. Surrogate tests may be used for QC testing of non-modified performance graded binders.

(e) Terminals or shipping facilities that blend performance graded binders from different sources, thatblend to produce a different performance grade, or that blend to modify the properties of an existing performance grade shall perform complete AASHTO M 320 specification compliance testing.

(f) The shipping facility shall document that each transport vessel was inspected prior to loading andwas found to be acceptable for the material being shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

1015.10.2.2 Quality Control Plan Test Data. The facility shall retain test data of specification compliance and QC testing for five years. At a minimum, the name of the facility, the dates of testing activity, results of individual specification compliance and QC tests identified by blender or tank number, and the mean, minimum and maximum test result for each specification compliance and QC test performed shall be readily available to MoDOT upon request.

1015.10.2.3 Approval of Laboratories. The supplier's primary testing laboratory shall be approved by MoDOT. The approval process will include split sample testing, and may include an on-site visit by department personnel. The primary testing laboratory shall be regularly inspected by the AASHTO Materials Reference Laboratory (AMRL). Any satellite testing laboratory operated by a supplier shall be inspected at the same frequency by the supplier's primary AMRL inspected laboratory staff, and a copy of the inspection report shall be forwarded to MoDOT.

1015.10.2.4 Failure to Comply. Failure to fulfill any of these requirements may result in disqualification of the performance graded binder supplier. If a primary manufacturing facility is disqualified, all terminals shipping performance graded binder manufactured at the primary facility and who are not performing AASHTO M 320 specification compliance testing will automatically be disqualified. In cases of dispute, test results obtained by MoDOT will be considered final.

1015.10.3 Characteristics. Performance graded asphalt binder shall be in accordance with AASHTO M 320 for the grade specified, except as follows. AASHTO T 111, Inorganic Matter or Ash in Bituminous Materials, may be substituted for AASHTO T 44, Solubility of Bituminous Materials, at the specification value indicated prior to the addition of ground tire rubber (GTR.) All blends containing GTR shall include 4.5 percent transpolyoctenamer rubber (TOR) by weight of the GTR. The direct tension test will be waived. The following additional requirements will apply:

Binder Characteristics		
Absolute Temperature Spread Between Upper and Lower Temperature for PG Binder Grade[a]	**Elastic Recovery[b], Percent, Minimum, AASHTO T 301**	**Separation Test[c], Percent Difference, Maximum, ASTM D 5976**
86 C	-	-
92 C	55	10
98 C	65	10
104 C	75	10

[a]Temperature Spread = Upper PG Temperature minus Lower PG Temperature. [b]Elastic recovery test to be performed on the residue from the Rolling Thin Film Oven Test at 25 C and 10 cm elongation.

[c]Separation test to be performed in accordance with ASTM D 5976, except test upper and lower portions as original binder for G* value according to AASHTO T 315 except for GTR binders that require continuous agitation.

1015.10.3.1 In lieu of AASHTO M 320, AASHTO M 332 may be substituted eliminating the elastic recovery requirement, except for use with Sec 413.30, Ultrathin Bonded Asphalt Wearing Surface. The equivalent grading of PG 64-22 is as follows: Grade S for PG 64-22, Grade H for PG 70-22 and Grade V for PG 76-22. Specialty grades will be tested at the grade temperature for the desired characteristics, i.e. PG 58-28 for RAS mixtures.

1015.10.4 Characteristics for GTR. Ground tire rubber shall be ambient ground, free of wire or other contaminating materials and not contain more than 0.1 percent fabric. Cryogenically ground rubber may be used by demonstrating that the GTR is satisfactorily suspended during all phases of production and storage. The gradation of the GTR shall be as follows:

Ground Tire Rubber	
Sieve Size	**Percent Passing by Weight**
No. 8	100
No. 16	100-96
No. 30	100-90
No. 50	20 min.

1015.10.4.1 Modification Process. The percentage by weight of binder shall be included with each lot of material. Ground tire rubber modified asphalt binder shall be tested and certified in accordance with Sec 1015.10.2 and may be incorporated by any of the following methods:

1015.10.4.1.1 Blending at HMA Plant. All sampling and testing shall be performed in accordance the requirements for terminal blending including high and low temperature testing.

1015.10.4.1.2 Terminal Blending. Blending and certification shall be in accordance with Sec 1015.

1015.10.5 Storage. Performance graded asphalt binder shall be furnished as a uniform mixture shipped directly to the project site from the asphalt binder supplier's permanent plant address or intermediate storage facility, suitable for direct use. Asphalt binder shall be capable of being stored at the project site without separation or settling. Automatic blending will be allowed at the terminal. Intermediate blending of asphalt binder and additives will not be

allowed at the project site, unless the asphalt binder is sampled at a point in the operation which captures the final blended binder with all additives incorporated.

SECTION 1015.20 LIQUID BITUMINOUS MATERIAL.

1015.20.1 Basis of Acceptance. Suppliers electing to furnish liquid bituminous material to MoDOT projects by QC/QA certification shall furnish material in accordance with Sec 1015.20.2. To become pre-qualified to furnish material, a written request shall be submitted to Construction and Materials, along with a copy of the supplier's QC plan. For source approval for any supplier of liquid bituminous material, split samples and an on-site laboratory inspection may be required. A manufacturer may forgo a formal QC plan and elect to perform full compliance testing, and certify each batch of material. If a manufacturer elects to forgo a formal QC Plan, all truck shipments shall be loaded from approved storage tanks that have been sampled, tested and certified by the supplier. If a manufacturer so elects, and automatic blending equipment is used, blender material will be approved for use provided the finished product is in accordance with this specification. At least one complete specification compliance test shall be conducted every two weeks on each grade of material furnished for MoDOT work from the blender. A certified copy of the test results shall be furnished to the engineer. For all liquid bituminous material, AASHTO T 111, Inorganic Matter or Ash in Bituminous Materials, may be substituted for AASHTO T 44, Solubility of Bituminous Materials, at the specification value indicated.

1015.20.2 Quality Control Plan Requirements. The QC plan shall be in accordance with the following:

(a) The plan may be written to cover multiple terminals, shipping facilities, blending or manufacturing-facilities.

(b) The plan shall state the location, organization and responsible personnel for each facility, includingthe physical address and telephone contact information. In general, following the guidelines in AASHTO R 26 will be acceptable.

(c) The plan shall state the minimum testing frequency for all material supplied. At a minimum, eachgrade of material supplied to MoDOT shall have complete specification compliance testing conducted monthly. Polymer modified material shall have complete specification compliance testing conducted every two weeks. The manufacturer’s internal QC testing frequency shall be approved by MoDOT prior to implementation. The manufacturer shall perform sufficient tests and at a frequency to ensure specification compliant material is being supplied to MoDOT at all times. For emulsified asphalt, QC testing on each batch, at a minimum, shall consist of viscosity, sieve test, determination of residue by either distillation or evaporation and an identifier test, if applicable, for that particular grade, either cement mixing, particle charge or demusibility. The manufacturer may elect to perform additional QC tests. For cutback material, QC testing shall be a minimum of the viscosity on a daily basis when material is being shipped to MoDOT work.

(d) In the event of a failing sample, the manufacturer shall follow the steps outlined in AASHTO R 26,Sec. 9.2. If a sample fails to comply with any specification requirement at the Central Laboratory, the manufacturer may only ship new material of that grade after full specification compliance testing. After the manufacturer has certified through specification compliance testing that three consecutive batches are in accordance with the material specification, the manufacturer may return to the testing frequency outlined in the QC/QA plan. If a second sample of the same grade from the same facility fails to comply with any specification requirement within the same calendar year, approval of that facility to supply that grade under QC/QA may be withdrawn. If approval for a grade is withdrawn, that material may only be supplied to MoDOT work after full certification compliance testing has been performed at the Central Laboratory. Re-approval to supply under the supplier’s QC/QA Plan will occur only after three consecutive batches meet specifications after testing at the Central Laboratory. Failure of multiple grades from a single facility tested at the Central Laboratory may result in that facility being removed from approval to supply material to MoDOT. Reinstatement will occur only after all materials in question have been tested at the Central Laboratory and have met all specifications, and documentation from the supplier outlining the reason for the failures and what corrective measures have been taken are to the satisfaction of MoDOT.

(e) The shipping facility shall document that each transport vessel was inspected prior to loading andwas found to be acceptable for the material shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

The results of QC/QA testing shall be retained by the supplier for a period of three years. A report containing all test results for any material shall be available to MoDOT upon request.

1015.20.3 Type RC Liquid Asphalt. Type RC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 81, invoking Note 3 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.4 Type MC Liquid Asphalt. Type MC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 82, invoking Note 4 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.5 Emulsified Asphalt. Non-polymer emulsified asphalt shall be in accordance with AASHTO M 140 or AASHTO M 208, for the type and grade specified in the contract.

1015.20.5.1 Polymer Modified Asphalt Emulsion - Seal Coat. Bituminous material for polymer modified asphalt shall be in accordance with the following:

Polymer Modified Asphalt Emulsion				
Test[a]	**CRS-2P**		**EA-90P**	
	Min	**Max**	**Min**	**Max**
Viscosity, SSF @ 50 C	100	400	100	400
Storage Stability Test[b], 24 hour, percent	----	1	----	1
Classification Test	Pass	----	----	----
Particle Charge Test	Positive	----	----	----
Sieve Test,percent	----	0.3	----	0.3
Demulsibility, 0.02 N $CaC1_2$, percent	----	----	30	----
Distillation:				
Oil distillate by volume of emulsion, percent	----	3	----	3
Residue from distillation[c] , percent	65	----	65	----
Tests on Residue from Distillation:				
Penetration,25 C, 100 g, 5 sec	100	200	100	200
Ductility, 4 C, 5 cm/minute, cm	30	----	25	----
Ash[d], percent	----	1	----	1
Float Test at 60 C, sec	----	----	1200	----
Elastic Recovery[e], percent	58	----	58	----

[a]All tests shall be performed in accordance with AASHTO T 59 except as noted.

[b]In addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be a homogeneous brown color throughout.

[c]AASHTO T 59 shall be modified to maintain a 399 F ± 10 F maximum temperature for 15 minutes.

[d]Percent ash shall be determined in accordance with AASHTO T 111, *Ash in Bituminous Material*. [e]Elastic recovery shall be determined as follows. Condition the ductilometer and samples to be treated at 50 F. Prepare the brass plate, mold and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 50 F for 85 to 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in the elongated position for 5 minutes. After 5 minutes, clip the sample approximately in half by means of scissors or other suitable

cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation (x) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

Polymer Modified Asphalt Emulsion		
Test[a]	**CHFRS-2P**	
	Min.	**Max.**
Viscosity, SFS @ 50 C	100	400
Storage Stability Test, 24 hour, percent	---	1.0
Demulsibility, 35 ml 0.8% dioctyl sodium sulfosuccinate, percent	60	---
Sieve Test, percent	---	0.10
Particle Charge Test	Positive	
Distillation[b] Oil Distillate, by volume of emulsion, percent Residue from distillation, percent	--- 65	0.5 ---
Tests on Residue from Distillation:		
Polymer content, weight, percent (solids based) Softening Point, C Float test at 60 C, s Penetration, 25 C, 100 g, 5 s Viscosity @ 60 C, Poise Solubility in Trichloroethylene, percent Elastic Recovery[c] @ 10 C , percent	3.0 54 1800 80 1300 95 65	 --- --- 130 --- --- ---

[a]All tests shall be performed in accordance with AASHTO T-59 except as noted. [b]AASHTO T59 shall be modified to maintain a 177 ± 5 C maximum temperature to be held for 20 minutes. Complete the total distillation in 60 ± 5 minutes from the first application of heat. [c]Elastic recovery shall be determined as follows. Condition the ductilometer and samples to be treated at 10 C. Prepare the brass plate, mold, and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 10 C for 85 to 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in the elongated position for 5 minutes. After the 5 minutes, clip the sample approximately in half by means of scissors or other suitable cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation recovery (X) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

1015.20.5.1.1 Polymer Modified Asphalt Emulsion - Tack Coat. Bituminous material for polymer modified asphalt shall be in accordance with the following:

Slow Setting Polymer Modified Asphalt Emulsion[a]					
		SS-1HP		CSS-1HP	
Test on Emulsion	Method	Min	Max	Min	Max
Viscosity, Saybolt Furol @ 25°C (77°F), s	AASHTO T 59	20	100	20	100
Particle Charge Test		Negative		Positive	
Storage Stability Test[b], 24 hr, percent	AASHTO T 59	--	1	--	1
Sieve Test, percent	AASHTO T 59	--	0.50	--	0.50
Residue by Distillation[c], percent	AASHTO T 59	57		57	
Oil Distillate by Distillation, percent	AASHTO T 59	--	--	--	--
Test on Residue from Distillation					
Penetration 25°C, 100 g, 5 s	AASHTO T 49	40	90	40	90
Elastic Recovery[d], 20 cm, 5 cm/min, 60 min, %	AASHTO T 301	30	--	30	--
Solubility in Trichloroethylene[e], %	AASHTO T 44	97.5	--	97.5	--

[a] The emulsified asphalt shall be in accordance with Sec 1015.20.5 of the 2011

Missouri Standard Specifications for Highway Construction, except as indicated above, and shall be modified with a styrene-butadiene diblock or triblock copolymer or a styrene butadiene rubber.

[b] In addition to AASHTO T 59, upon examination of the test cylinder, and afterstanding undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be homogeneous brown color throughout. The storage stability test may be waved provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, provided satisfactory field results are obtained.

[c] AASHTO T 59 shall be modified to use a lower distillation temperature of 177° C(350° F). [d] AASHTO T 301 shall be modified to allow the residue to be obtained from distillation as long as the distillation temperature is modified as stated above. The test on residue shall be conducted at a temperature of 10° C (50° F).

[e] In lieu of performing AASHTO T 44, AASHTO T 111, Ash in Bituminous Material, may be performed with a maximum allowable percent ash of 1.0 percent.

1015.20.5.2 Asphalt Emulsion for Micro-Surfacing. Bituminous material for micro-surfacing shall be a polymer modified asphalt emulsion, grade CSS-lh, in accordance with the following table. The bituminous material shall show no separation after mixing. A minimum of 3.0 percent polymer content, by mass, of an approved polymer shall be milled into the asphalt emulsion at the time of manufacture of the emulsion. The emulsion shall be sampled in accordance with AASHTO T 40.

Micro-Surfacing Emulsion (MSE-1)			
	Min.	**Max.**	**Test Method**
Viscosity, Saybolt Furol at 77 F, s	20	100	AASHTO T 59
Storage stability test, 24 hr,	- -	1a	AASHTO T

percent			59
Particle charge test positive[b]			AASHTO T 59
Sieve test, percent	- -	0.50	AASHTO T 59
Residue, percent	62	- -	AASHTO T 59
Tests on Residue from Distillation	**Min.**	**Max.**	**Test Method**
Penetration, 77 F, 100 g, 5 s,	40	90	AASHTO T49
Ductility, 25 C, 5cm/min, cm,	40	- -	AASHTO T 51
Solubility in Trichloroethylene, %	97.50	- -	AASHTO T 44

[a]The storage stability test may be waived provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, and provided satisfactory field results are obtained.

[b]If the particle charge test is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

1015.20.5.3 Scrub Seal Emulsion. Scrub seal emulsion shall be smooth and homogeneous, polymer modified, shall contain an asphalt rejuvenator and shall be in accordance with the following:

Scrub Seal Emulsion (SSE-1)			
	Min.	**Max.**	**Test Method**
Saybolt Furol Viscosity, SFS @ 77 F	30	100	AASHTO T 59
Storage Stability Test[a] , 24 hr., %	--	1a	AASHTO T 59
Demulsibility, 35 ml of 0.02N, $CACl_2$, %	--	60	AASHTO T 59
Sieve Test[b], percent	--	0.3	AASHTO T 59
Residue by Distillation[(c)] @ 401 ± 10 F, %	60	--	AASHTO T 59
Oil Distillate by Volume, percent	--	3	AASHTO T 59
Tests on Residue from Distillation	**Min.**	**Max.**	**Test Method**
Penetration @ 77 F, 5 s, 100 g, dmm	100	300	AASHTO T 49
Float Test @ 140 F, s	1200	--	AASHTO T 50
Ash, percent	--	1	AASHTO T 111
Elastic Recovery, 10 C, 200 mm elongation, 60 min.	30	--	ASTM D

recovery, percent			5976
Saturates[d], percent	- -	20	ASTM D 4124

[a]Upon examination of the test cylinder after standing undisturbed for 24 hours, the surface shall show no white, milky colored substance and shall be a homogeneous brown color throughout. [b]A percentage of 0.30 will be acceptable for samples taken at the point of use or shipped to the Central Laboratory for testing.
[c]ASTM D 244 shall be modified to include a 205 ± 5 C maximum temperature to be held for 15 minutes.
[d]ASTM D 4124 shall be modified to use Alumina, CG - 20 Grade, available from Aluminum Company of America, Pittsburgh, PA.

1015.20.5.4 Hard Penetration Asphalt Emulsions (SS-1vh). The hard penetration asphalt emulsions shall be in accordance with the following:

Emulsion Properties of Hard Penetration Asphalt Emulsions (SS-1vh)			
Test on Emulsion	**Method**	**Min.**	**Max.**
Viscosity, Saybolt Furol @ 25º C (77º F), s	AASHTO T 59	20	100
Storage Stability Test[a], 24 hr., percent	AASHTO T 59	--	1.0
Sieve Test, percent	AASHTO T 59	--	0.30
Residue by Distillation, percent	AASHTO T 59	50	--
Oil Distillate by Distillation, percent	AASHTO T 59	--	1
Tests on Residue from Distillation	**Method**	**Min.**	**Max.**
Softening Point, º F	AASHTO T 53	149	200
Penetration 25º C (77º F), 100 g, 5 s	AASHTO T 49	--	40
G* / sin delta @ 76º C – 10 rad/sec, kPa	AASHTO T 315	1.0	--
Solubility in Trichloroethylene[b], %	AASHTO T 44	97.5	--

[a]In addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be homogeneous brown color throughout. The storage stability test may be waved provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, provided satisfactory field results are obtained.
[b]In lieu of performing AASHTO T 44, AASHTO T 111, Ash in Bituminous Material, may be performed with a maximum allowable percent ash of 1.0 percent.

1015.20.6 Ultrathin Bonded Wearing Surface. Bituminous material for ultrathin bonded wearing surface shall be in accordance with the following.

1015.20.6.1 Asphalt Binder. The asphalt binder shall be in accordance with Sec 1015.10, and specifically as follows:

Tests	**Method**	**Min.**	**Max.**
Separation Test, %	AASHTO PP-5		10

Elastic Recovery Test, %	ASTM D 6084	65	

1015.20.6.2 Polymer Modified Emulsion Membrane. The anionic or cationic emulsion shall be polymer modified and shall be in accordance with one of the following:

Anionic Polymer Modified Emulsion Membrane (PEM-1)				
Tests on Emulsion		**Method**	**Min.**	**Max.**
Viscosity, Saybolt Furol @122°F, s		AASHTO T 59	25	125
Storage Stability Test[a], 24 h, percent		AASHTO T 59		1
Sieve Test[b], percent		AASHTO T 59		0.3
Residue by Distillation[c], percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibilty, %	35 ml, 0.02 N $CaCl_2$	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, percent		AASHTO T 301	60	

Cationic Polymer Modified Emulsion Membrane (CPEM-1)				
Tests on Emulsion		**Method**	**Min.**	**Max.**
Viscosity, Saybolt Furol @122°F, s		AASHTO T 59	25	125
Storage Stability Test[a], 24 h, percent		AASHTO T 59		1
Sieve Test[b], percent		AASHTO T 59		0.3
Residue by Distillation[c], percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibility, %	35 ml, 0.8% dioctyl sodium sulfosuccinate	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, %		AASHTO T 301	60	

[a]After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.
[b]The sieve test will be waived if successful application of the material has been achieved in the field.
[c]AASHTO T 59 shall be modified to include a 400 F ± 10 F maximum temperature to be held for a period of 15 minutes.

END OF SECTION 321216

SECTION 321313 - CONCRETE SITE WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior Portland cement concrete (PCC) pavement and appurtenances for the following:

1. Driveways and Roadways
2. Parking lots
3. Curbs and Gutters.
4. Sidewalks
5. Exterior Structures

1.2 SUBMITTALS

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

B. Design Mixtures: For each concrete pavement mixture.

C. Pavement Jointing Plan

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, epoxy coated.

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 or IL

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:

Uses	Strength (28 days)	*Cement Content (min)
Driveways and Road-ways, Parking lots, Curbs and Gutters, Sidewalks, Exterior Structures and General Concrete	4,000 psi	570 - lbs/Cu Yd

*Fly Ash may be substituted in accordance with Sec. 2.2 J.

G. Consistency shall be such that the mixture can be worked into all parts of the forms and around the reinforcing steel of the structure, without segregation of the materials or the appearance of free water on the surface of the concrete. Unless otherwise stated, the slump measured in accordance with ASTM C143 shall be within the following limits.

1. Pavements, walks, and slabs 2" to 4"
2. Forms 9" wide or over 2" to 4"
3. Forms less than 9" wide 3" to 5"

H. All concrete be air entrained, containing between 4% and 7% entrained air, after mixing is complete and just prior to placement.

I. Pumped concrete shall comply with ACI 304 and these specifications.

J. Fly Ash shall not be used after October 15 and before April 1. The amount of fly ash shall not exceed 20% of cementitious material and the replacement ratio (fly ash to cement replaced) shall be a minimum of 1.5:1.

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 CONCRETE PROTECTION

A. All placed concrete pavements, sidewalk and curb and gutters shall have a penetrating siloxane or silane-based sealer. The sealer product shall be non-yellowing compound that forms a breathable internal membrane that combats freeze/thaw damage, reduce scaling and spalling, impart water repellence, and restrict moisture absorption, deicing chemicals and salts, acid rain deterioration, alkali attack, corrosion of reinforcing steel, and UV damage.

2.5 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. The Architect/Engineer shall approve the paint manufacturer.

1. Color: Yellow for Parking Strips and Accessibility Parking stripes and hatching. White for all other symbols, words, and arrows.

2.6 DETECTABLE WARNING PANELS (not applicable)

A. Detectable Warnings.

1. Detectable Warnings shall consist of a surface of truncated domes meeting the requirements of the ADAAG and the details show on the plans. The installation shall be an integral part of the walking surface and only the domes shall project above the walking surface. The panel shall be available in standard colors to allow a contrasting appearance. Panel color shall be throughout the entire thickness. The panels shall carry a minimum five (5) year manufacturer's warranty.

2. The material, equipment and installation procedures used shall be according to the manufacturer's specifications.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART - 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Subgrade preparation shall be in accordance with Section 3.6 of 312300 Excavation and Fill of these specifications.

B. Geotextile Fabric, Geogrid and Aggregate Base shall be in accordance with Section 321123 Aggregate Base Courses of these specifications.

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.

B. Epoxy coated bars will not be required.

3.4 JOINTS

A. General: Joints in sidewalks and driveways shall be by tooling while the concrete is plastic. Sawed joint may be allowed in pavements and curbs. All sidewalks, driveways and pavements shall be edged. Deformed steel tie bars in Longitudinal Construction Joints shall be placed by drilling and epoxy setting when adjacent slabs are to be constructed separately. 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. Sawed contraction joints for a depth equal to at least one-fourth of the concrete thickness. Sidewalk joints shall be tooled and not sawed.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces. Tool joints on all sidewalks and in locations indicated on the Drawings.

F. Contractor shall submit a jointing plan for approval by owner's representative prior to placing any concrete pavement.

3.5 CONCRETE PLACEMENT AND FINISHING

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. Strike Off, Consolidation and Finishing: The pavement may be placed utilizing an approved vibrating screed or other approved strike-off and consolidating machine that provides a surface that is uniform texture, true to grade and cross section and free from porous areas. Additional consolidation with handheld or machine vibrators in front of strike off may be necessary if adequate consolidation is not being achieved. Longitudinal hand bull floating with a float having a min. width of 5 ft for non-vehicular slabs and a min. width of 10 ft for vehicular use slabs will be required. Floats or darbies shall be used at all edges as necessary to provide a uniform surface plane.

E. General: Do not add water to concrete surfaces during finishing operations.

F. Exterior Finish:

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.

G. Interior (smooth) 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 floating to a trowel smooth surface.

H. Apply surface treatments, if any, per manufacturer's recommendations.

3.6 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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.7 CONCRETE PROTECTION

A. Apply penetrating permanent concrete protection treatment to all concrete pavements, sidewalk and curb and gutters at the time and rates as required by the manufacturer.

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 3/16 inch.
4. Joint Spacing: Max 2 times slab thickness (inches) times 24.
5. Contraction Joint Depth: 1/3 slab thickness, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

B. Curb tolerances:

1. Finished curb surfaces including curb top, face and gutter line shall not vary more than a ¼" from the testing edge of a 10 foot straightedge. Permissible deficiencies in section thickness will be up to a ¼".

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. Remove any oil or grease.

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 16 mils.

D. Paint shall not be applied at air temperatures below 40 degrees F.

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 sidewalk 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 hot-poured joint sealer in compliance with Article 502.5.4 and Article 1057.5.

1. The hot poured sealer shall be placed utilizing a "V" shaped wand tip, to allow penetration of the materials into the joints while providing neat completely filled joints.

2. Joints shall be completely filled or over banded not to exceed 1½". Excessive over banding shall be removed as directed by the A/E.

3.12 FIELD QUALITY CONTROL

A. The **Owner** shall 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: As noted in Section 2.2 G - 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 five (5) 4" x 8" cylinder specimens for each composite sample.
   b. Cast and field cure one additional cylinder specimen for each composite sample for cold or hot weather concrete.
7. Compressive-Strength Tests: ASTM C 39/C 39M;
   a. 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.
   b. 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

SECTION 323113 -CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Chain-Link Fences: **Industrial**
2. Gates: **Swing**.

1.2 SUBMITTALS

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

B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Height indicated on Drawings. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: **Metallic** wire with a diameter of **0.148 inch**.

a. Mesh Size **2 inches**
b. Metallic (Zinc) Coating: ASTM A 392, Type II.

2. Selvage: **Knuckled at both selvages**.

2.2 INDUSTRIAL FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:

1. Group: **IA, round steel pipe, Schedule 40**].
2. Fence Height: **6 feet**
3. Strength Requirement: **Heavy** industrial according to ASTM F 1043.
4. Coating for Steel Framing:

a. Metallic coating.

2.3 TENSION WIRE

A. General: Provide horizontal tension wire at **bottom** of fence fabric.

B. Metallic-Coated Steel Wire: 0.177-inch - diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.

1. Metallic Coating: Type III, Zn-5-Al-MM alloy.

2.4 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for **single** and **double** swing gate types.

1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from **round** tubing with outside dimension and weight according to ASTM F 900 and the following:

1. Gate Fabric Height: **2 inches less than adjacent fence height**.
2. Leaf Width: **As indicated on plan sheets**.
3. Frame Members:

a. Tubular **Steel**: **1.90 inches round**.

C. Frame Corner Construction:

1. Assembled with corner fittings and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.

D. Hardware: Latches permitting operation from both sides of gate, hinges, **center gate stops** and keepers for each gate leaf more than five (5) feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.6 CAST-IN-PLACE CONCRETE

1. Concrete shall be in accordance with Section 321313 Concrete Paving of these specifications.

2.7 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: **Aluminum**.
2. Material on or below Finished Grade: Copper.

3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts **in concrete** or with **mechanical anchors on concrete pavements** at indicated spacing into firm, undisturbed soil.

1. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.

E. Line Posts: Space line posts uniformly at **10 feet maximum** o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides of corner and pull posts.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing.

H. Top Rail: Install according to ASTM F 567.

I. Chain-Link Fabric: Apply fabric to **outside** of enclosing framework. Leave **1 inch** between finish grade or surface and bottom selvage, unless otherwise indicated.

J. Tie Wires: Attach wire per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.3 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of **500 feet**.

1. Grounding Method: At each grounding location, drive a grounding rod vertically until the **top is 6 inches below finished grade. Using fittings designed for this application, connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location. Remove polymer coating to ensure an electrically conductive path where the grounding connectors are attached to the fence components.**

B. Bonding Method for Gates:

1. Install fence grounding at each gate operator, with a bonding jumper installed between the fence ground rod and the EGC for the branch circuit supplying power to the gate operator.

C. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

END OF SECTION 323113

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. Newly seeded lawns shall be warranted through the lawn maintenance period and until final acceptance.

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: 20:10:10, 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 (No KY31)	50%	90%
Chewing Red Fescue	30%	90%
Perennial Ryegrass	10%	90%
Annual Rye	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 us 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

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.

3.4 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.

3.5 HYDRAULIC SEEDING

A. Order of Operations:

1. Seedbed Preparation
2. Seed application, fertilizing and mulching
3.

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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

D. Remove all excess materials, debris, and equipment upon completion of work.

E. Repair any damage resulting from seeding operations.

F. 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.

3.10 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 330513 - MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Section 013300 - Submittals.

B. Product Data: Submit manhole covers, component construction, features, configuration, and dimensions.

1.2 REFERENCES

A. ASTM A48 - Gray Iron Castings.

B. ASTM A536 - Ductile Iron Castings.

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM C497 - Test Method for Concrete Pipe, Manhole Sections, or Tile.

1.3 DESIGN REQUIREMENTS

A. Equivalent strength shall be based on structural design of reinforced concrete as outlined in ACI 318.

B. Design of lifting devices for precast structures shall conform to ASTM C 913.

C. Design of joints for precast structures shall conform to ASTM C 913. Joints shall be designed for leakage not to exceed 0.025 gallons per hour per foot of joint at 3 feet of head.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with product storage and handling requirements within these specifications.

B. Comply with precast concrete manufacturer’s instructions for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to the Owner’s property or other public or private property, and any property so damaged shall be repaired at the Contractor’s expense.

D. Clearly mark each precast structure by indentation or waterproof paint to indicate the date of manufacture, manufacturer and identifying symbols and/or numbers shown on the Contract Drawings to indicate its intended use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: ACI 530.

PART 2 - PRODUCTS

2.1 MANHOLES, FRAMES, AND COVERS

A. Manufacturers:

1. Neenah Foundry Co.
2. East Jordan Iron Works, Inc.
3. Or Engineer approved equal

B. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with Butyl Joint Sealant in accordance with ASTM C990, AASHTO M198.

2.2 COMPONENTS

A. Lid and Frame: ASTM A48, Class 35B Cast iron construction, machined flat bearing surface, removable lid, heavy duty load rating.

B. Manhole Steps: Plastic coated steel equal to MA-1.

2.3 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch diameter or as scheduled on the drawings.

D. Design Depth: As indicated.

E. Clear Lid Opening: As indicated.

F. Pipe Entry: Provide openings as indicated.

G. Steps: 12 inches wide, 16 inches on center vertically, set into manhole wall. As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with the provisions of Section 013100- Coordination

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into Work.

D. Verify excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or required by other sections.

B. Do not install structures under site conditions known to result in loads heavier than that for which the structure was designed.

C. Inspect precast concrete structures immediately prior to placement in the excavation to verify that they are internally clean and free from damage. Remove damaged units from the construction site and replaced, at no additional cost to the Owner.

3.3 INSTALLATION

A. Excavation and Backfill:

1. Excavate for manholes and drainage structures in accordance with Section 312333 Trenching and Backfilling in the location and to depth shown. Provide clearance around the sidewalls of the structure as required for construction.
2. If groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in a dry trench.
3. Where the possibility exists of a watertight structure becoming buoyant in a flooded excavation, take necessary steps to avoid flotation of the structure.

B. Place manhole sections plumb and level.

C. Manholes and drainage structures shall be supported at proper grade and alignment on crushed stone bedding or other support system, as shown on the Contract Drawings.

D. Backfill excavations for manholes and drainage structures in accordance with Section 312333 Trenching and Backfilling.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND DRAINAGE STRUCTURE INSTALLATION

A. To ensure safety, lift precast structures at the lifting points designated by the manufacturer.

B. When lowering manholes and drainage structures into the excavations and joining pipe to the units, take precautions to ensure that the interior of the pipeline and structure remains clean.

C. Set precast structures so that they firmly and fully bear on compacted crushed stone bedding or on other support system shown on the Contract Drawings.

D. Assemble multi-section structures by lowering each section into the excavation. Lower, set level, and firmly position the base section before placing additional sections.

E. Ensure joint integrity by removing all foreign materials from joint surfaces and verifying that sealing materials are placed properly. Avoid misalignment by using guide devices affixed to the lower section.

F. Joint sealing materials shall be installed at the site. Use preformed butyl rubber rope sealant.

G. Verify that manholes and drainage structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping so as not to create openings more than that required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of structure.

J. Shape inverts through manhole as shown on the Contract Drawings.

3.5 CASTINGS INSTALLATION

A. Set frames on butyl rope sealant for sanitary manholes. Also seal between any precast rings installed.

B. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow the area to be graded away from the cover beginning 1 inch below the top surface of the frame.

3.6 FIELD QUALITY CONTROL

A. Field tests will be used to evaluate and approve concrete in accordance with Section 030000.

B. Vertical Adjustment of Existing Manhole and Drainage Structures:

1. Where required, adjust the top elevation of existing manholes and drainage structures to suit finished grades shown on the Contract Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of all mortar fragments, to the required elevation in accordance with the requirements specified for installation of castings.

END OF SECTION 330513

SECTION 331100 - SITE WATER DISTRIBUTION

PART - 1 GENERAL

1.1 SUMMARY

A. All work shall be in accordance with standards of the Missouri Department of Natural Resources for Community Water Supplies, Part 8, Current Edition.

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.

PART - 2 PRODUCTS

2.1 WATER PIPE MATERIALS

A. Polyvinyl Chloride (PVC) IPS Pressure Pipe:
   1. Minimum Wall Thickness:
      a. 3 inch size: SDR 17
   2. Joint Type: Use push-on joint type, except as otherwise specified in the contract documents or as authorized by the Engineer.
      a. Push-on: According to ASTM D3139 and ASTM F477.
      b. Integral Restrained Joint: PVC pipe with restraining system manufactured integrally into pipe end.
      c. Mechanical Restrained Joint: Ductile iron mechanical device designed for joint restraint of PVC pipe complying with the requirements of ASTM F 1674.
   3. Markings on Pipe:
      a. Name of manufacturer.
      b. Size and class.
      c. Spigot insertion depth gauge.
      d. National Sanitation Foundation (NSF) seal.

B. HDPE Pressure Pipe:
   1. Material Designation Code: PE4710 and Comply with AWWA C906 with ductile iron pipe equivalent outside diameters.
   2. Minimum Thickness Class:
      a. 2-inch size: DR 9
   3. Joint Type: Fusible
   4. Provide pipe extruded with plain ends square to the pipe, free of any bevel or chamfer, and without bells or gaskets of any kind

C. Ductile Iron Pipe (DIP) (Not Applicable):
   1. Minimum Thickness Class:
      a. 4 inch through 24 inch sizes: Special thickness Class 52 according to AWWA C151.
      b. Cement-mortar Lined: According to AWWA C104 with asphalt seal coat.
      c. External Coating: Asphalt according to AWWA C151.

2. Joint Type: Use push-on type, unless otherwise specified in the contract documents or as authorized by the Engineer.
    a. Push-on: According to AWWA C111.
    b. Mechanical: According to AWWA C111.
    c. Restrained, Buried: Pipe manufacturer's standard field removable system.
    d. Restrained, in Structures: Restraining gland, flanged or grooved.
    e. Flanged: According to AWWA C111.
    f. Grooved: According to AWWA C606.
    g. Gaskets: According to AWWA C111.
3. Markings on Pipe:
    a. Name of manufacturer.
    b. Size and class.
    c. Spigot insertion depth gauge.

D. Bolts for Water Main and Fittings
1. Tee-bolts and Hexagonal Nuts for Mechanical Joints (Use corrosion resistant bolts):
2. High-strength, low-alloy steel manufactured according to AWWA C111.
3. Provide ceramic-filled, baked-on, fluorocarbon resin coating for bolts and nuts.
4. Include factory-applied lubricant that produces low coefficient of friction for ease of installation.

E. Water Service Piping
1. Materials (as allowed by Jurisdiction or specified in contract documents):
    a. Copper Pipe:
        1) Comply with ASTM B 88.
        2) Wall Thickness: Type K.
    b. PVC Pipe (Not Applicable):
        1) ASTM D 1785, Schedule 80 or ASTM D 2241, SDR 21. Provide solvent weld joints for all pipes.
    c. Polyethylene Pipe:
        1) Class 200, according to AWWA C901.
    d. PEX-A pipe:
        1) ASTM F 876 and F877
        2) Fittings: F1807 brass or stainless steel insert fittings with copper crimp rings.

2.2 FITTINGS
1. For DIP and PVC Pipe: Comply with AWWA C110 (ductile iron or gray iron) or AWWA C153 (ductile iron).
    a. Joint Type:
        1) For pipe sizes 16 inches and less, use mechanical joint complying with AWWA C111.
        2) For pipe sizes greater than 16 inches, use restrained mechanical joint system.
        3) Provide follower gland using breakaway torque bolts to engage thrust restraint.
            a) Minimum pressure rating same as connecting pipe. For fittings between dissimilar pipes, the minimum pressure rating is the lesser of the two pipes.
            b) Suitable for buried service.
            c) Joint restraint system to be field installable, field removable, and re-installable.
        4) Use of alternate restraint systems must be approved by the Engineer.
    b. Lined: Cement mortar lined according to AWWA C104 with asphalt coating.
    c. Wall Thickness: Comply with AWWA C153.
    d. Gaskets: Comply with AWWA C111.
2. Flange Adapter:
    a. Body: Ductile iron complying with ASTM A 536.
    b. End Rings (Follower Rings): Ductile iron complying with ASTM A 536.
    c. Gaskets: New rubber compounded for water service and resistant to permanent set.
    d. Bolts and Nuts: High strength, low alloy corrosion resistant steel or carbon steel bolts complying with ASTM A 307.

3. Pipe Coupling:
    a. Center Sleeve (Center Ring): Steel pipe or tubing complying with ASTM A 53 or ASTM A 512, or formed carbon steel with a minimum yield of 30,000 psi.
    b. End Ring (Follower Ring): Ductile iron complying with ASTM A 536, or steel meeting or exceeding the requirements of ASTM A 576, grade 1010-1020.
    c. Gaskets: New rubber compounded for water service and resistant to permanent set.
    d. Bolts and Nuts: High strength, low alloy corrosion resistant steel.

2.3 VALVES

A. General
1. The opening direction is counterclockwise as viewed from the top, unless otherwise specified in the contract documents or as directed by the Jurisdiction.

B. Gate Valves:
1. Standards: Comply with AWWA C509 (gray iron or ductile iron) or AWWA C515 (ductile iron) and NSF 61.
2. Stem Seals: Double O-rings permanently lubricated between seals. Lubricant certified for use in potable water.
3. External Bolts and Hex Nuts: Stainless steel according to ASTM A 240, Type 304.

C. Tapping Valve Assemblies:
1. Tapping Valve: Gate valve complying with AWWA C509 or AWWA C515.
2. Saddle, Mueller S-13000 series, Ford S912 series, PowerSeal 3403 series or approved equal:
    a. Brass or bronze according to ASTM B62 or ASTM B98.
    b. Working pressure 150 psi minimum.
    c. Must fully surround pipe.

2.4 STOPS

A. Corporation Stops:
1. AWWA C800 (Mueller “CC”) threaded inlet,
2. Acceptable Materials: Mueller B-25008N, Ford FB Ballcorp type, AY McDonald 74701BQ, or Approved Equal.

B. Curb Stops:
1. Size per Plan - Inlet and Outlet flared copper.
    a. Acceptable Material: Mueller H-15209N, AY McDonald 74713Q, Ford B44-xxxHST-Q-NL style, or Approved Equal.

2.5 BOXES AND LIDS

A. Curb Boxes:
1. Cast Iron construction, extension type with one piece lid, stationary shut off rod, and arch type box.
2. Acceptable Materials: Mueller H-10314 Series, AY McDonald 5604A series, Ford EA1- series, or Approved Equal.

B. Valve Boxes:
1. Cast Iron construction, Two section screw type with availability to add extensions to increase lengths adequate to bring up to finished grade, Inside diameter of 5 1/4”, Covers with “WATER” cast into the lid, Factory Finish: Asphalt coating
    a. Acceptable Materials: Tyler Model 564S, SIP Industries Series 6000, Castings Incorporated 6850 Series, or Approved Equal.

2.6 CONCRETE THRUST BLOCKS

1. Concrete shall be in accordance with Section 311313 Concrete Site Work of these specifications.
2. Comply with the contract documents for dimensions and installation of thrust blocks.

2.7 TRACER WIRE

1. Water Pire in Open Cut:
    a. Solid Single Copper Conductor:
        1) Size: #12 AWG
        2) Insulation Material: Linear low-density polyethylene (LLDPE) installation suitable for direct burial applications
        3) Insulation Thickness: 0.030 inches, minimum
        4) Insulation Color: Blue
        5) Tensile Strength: 150 pounds, minimum
        6) Operating Voltage: Rated for 30 volts
2. Directional Drilling/Boring:
        1) Bimetallic Copper Clad Steel Conductor:
            a) Size: #12 AWG
            b) Operating Voltage: Rated for 30 volts
            c) Copper Cladding: 3% of conductor diameter, minimum
            d) Insulation Material: High density, high molecular weight polyethylene
            e) Insulation Thickness: 0.045 inches, minimum
            f) Insulation Color: Blue
            g) Tensile Strength: 1,100 pounds, minimum

2.8 YARD HYDRANT ASSEMBLY

A. Material: Freezeless Yard Hydrant
1. Bury Depth: 5 feet
2. Female Inlet: 3/4” NPT
3. Casing: 1” Galvanized Steel Pipe
4. Operating Rod: 3/8” Stainless Steel Pipe
5. Drain Hole: Tapped - ⅛″ N.P.T.
6. Removable Nozzle: ¾″ Brass Male Hose Nozzle
7. Acceptable Material:
    a. Woodford “Iowa” Yard Hydrant
    b. Merrill Manufacturing
    c. Simmons Manufacturing
    d. Approved Equal.

PART - 3 EXECUTION

3.1 PREPARATION AND 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 (811) service and the Owner or his/her onsite representative 48 hours prior to start of work.

C. Field Conditions: Verify location and elevation of existing facilities were connections are to be made.

3.2 GENERAL

A. Do not use deformed, defective, gouged, or otherwise damaged pipes or fittings.

B. Keep trench free of water. Clean pipe interior prior to placement in the trench.

C. Install pipe with fittings and valves to the lines and grades specified in the contract documents.

D. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water and recommended by the manufacturer.

E. Push pipe joint to the indication line on the spigot end of the pipe before making any joint deflections.

F. Limit joint deflections to one degree less than pipe manufacturer's recommended maximum limit.

G. Tighten bolts in a joint evenly around the pipe.

H. Set tops of valve boxes to finished grade, unless otherwise directed by the Engineer.

I. Check the working order of all valves by opening and closing through entire range. Before opening the valves, check with the Jurisdiction on operating requirements.

J. Keep exposed pipe ends closed with rodent-proof end gates at all times when pipe installation is not occurring.

K. Close the ends of the installed pipe with watertight plugs during nights and non-working days.

L. Do not allow any water from the new pipeline to enter the existing distribution system piping until testing and disinfection are successfully completed.

3.3 INSTALLATION

A. Excavation and backfilling for water lines 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.

B. 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.

C. Depth of Cover:
   1. All water pipe shall be laid with a minimum of four (4.0) feet of cover over the top of the pipe.

D. Trenched Water Pipe:
   1. Excavate trench and place pipe bedding and backfill material as specified in Section 312333 Trenching and Backfilling.
   2. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.
   3. Cut the pipe perpendicular to the pipe barrel. Deburr and bevel cut spigot end of the pipe barrel to match factory bevel. Re-mark the insertion line.
   4. When connecting to shallow-depth bells, such as on some cast iron fittings or valves, cut the spigot end square to remove factory bevel. Deburr the end and form a partial bevel on the end.

E. Water Service Stub:

1. Install water service pipe, corporations, stops, and stop boxes according to local Jurisdiction requirements.
2. Install 1 inch and smaller corporation valves tapped at 45 degrees above horizontal at a minimum distance of 18 inches from pipe bell or other corporation. Install 1 1/2 inch and 2 inch corporation valves tapped horizontal a minimum distance of 24 inches from pipe bell or other corporation.

F. Tracer Wire:
1. Install with all buried water main piping per specified details.
2. Begin and terminate the system at all connections to existing mains.
3. Install wire continuously along the lower quadrant of the pipe. Do not install wire along the bottom of the pipe. Attach wire to the pipe at the midpoint of each pipe length; use 2 inch wide, 10 mil thickness polyethylene pressure sensitive tape.
4. Install splices only as authorized by the Engineer. Allow the Engineer to inspect all below grade splices of tracer wire prior to placing the backfill material.
5. Install ground rods adjacent to connections to existing piping and at locations specified in the contract documents or as directed by the Engineer.
6. Bring two wires to the surface at each fire hydrant location and terminate with a tracer wire station.
7. Final inspection of the tracer system will be conducted at the completion of the project and prior to acceptance by the owner. Verify the electrical continuity of the system. Repair discontinuities.

G. Water Main and Sewer Pipe Separation:
1. Horizontal and Vertical Separation of Gravity Sewers from Water Mains shall be in accordance with MoDNR Specifications.

3.4 TESTING AND DISINFECTION

A.

A. Upon completion of the new water main installation a Waterline Pressure Test Report shall be performed for each waterline installed. The pressure and leakage tests shall be in accordance with the latest edition of AWWA Standards and manuals.

B. Disinfecting: The pipe and appurtenances shall be disinfected in in accordance with the latest edition of AWWA Standards and manuals and as approved by the MO DDNR:

1. The Contractor shall take and deliver bacteriological samples to a certified lab for analysis. Cost for sampling and analysis required, will be at the expense of the Contractor.
2. All testing, filling, flushing, and disinfections of new water main are to be conducted in accordance with the latest edition of AWWA Standards and manuals.
    a. All manpower, materials and equipment are to be provided by the contractor.
    b. The State Parks must be notified a minimum of 2 working days prior to the work being performed so as to assign and schedule with the Parks.
3. Sterilizing of the completed lines shall be done in accordance with AWWA C651 and in a manner approved by the Missouri Department of Natural Resources.
4. Prior to chlorination, the main shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure tests are made. After flushing, all valves shall be carefully inspected to see that the entire operating mechanism is in good condition.
5. Following sterilization, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served the public from the existing water supply system and approved by the Owner. This quality of water delivered by the new main should continue for a period of at least two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination. Samples shall not be taken from an unsterilized hose or from a fire hydrant. The Contractor shall perform or cause to perform all testing.
6. Should the initial treatment fail to result in the condition specified in the preceding paragraph, the sterilizing procedure shall be repeated until such results are obtained.

3.5 FIELD QUALITY CONTROL

A.

1. The **Owner** will provide testing services of a soils engineer and/or independent laboratory for this project. Trenching and backfilling testing shall be completed in accordance with Section 312333 "Trenching and Backfilling" of these Specifications

END OF SECTION 331110

SECTION 333217 - SUBMERSIBLE WASTEWATER PUMPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor shall furnish and install components for raw sewage submersible pumping stations, including fiberglass wet wells. pumps, guiderail pump removal equipment and lifting devices, stainless steel piping, valves, and appurtenances, all as shown on the Drawings and described herein.

1.2 SUBMITTALS

A. The following information shall be submitted to the Engineer in accordance with Section 013300. Submittals shall include the following at a minimum:

1. Product data, including:

    a. Descriptive literature, brochures, catalogs, cut sheets and other detailed descriptive material of the equipment.
    b. Pump operating curves with flow, head, efficiency, $NPSH_r$ and brake horsepower over the entire range of operation from deadhead to run-out.
    c. Motor data with service factor, amperage draw, efficiency, temperature ratings, etc.
    d. Recommendations for short and long term storage.
    e. A copy of the manufacturer' warranty.

2. Shop drawings, including:

    a. Dimensioned drawings of equipment.
    b. Manufacturer's installation drawings.
    c. Wiring diagrams.
    d. Control panel layout.

3. Installation Manual.
4. Operation and Maintenance Manuals, including:

    a. Product information of all materials and pumps, including pump operating curves.
    b. Parts reference list for all equipment and materials.
    c. Motor type, size, operation information, parts lists, and service information.
    d. Maintenance and service schedules for all equipment.

1.3 QUALITY ASSURANCES

A. Contractor shall obtain approval for all equipment and materials. Contractor shall be a firm experienced in mechanical and electrical work.

B. Responsibility:

1. It shall be the responsibility of the Contractor to furnish a complete and fully operating system, completely compatible with the functions required.
2. The Contractor shall be responsible for all details, which may be necessary to properly install, adjust and place into operation the complete installation.
3. The Contractor shall assume full responsibility for additional costs, which may result from unauthorized deviations from the specifications.

1.4 MANUFACTURER'S FIELD SERVICE

A. The services of a factory-trained, qualified service representative of the equipment manufacturer shall be provided to inspect the complete equipment installation to ensure that it is installed in accordance with the manufacturer's recommendations, and make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in proper care and operation of the equipment furnished. The manufacturer shall provide the Owner with written certification that the equipment is correctly installed and adjusted.

PART 2 - PRODUCTS

2.1 WET WELL

A. General:

1. Wet wells shall be of fiberglass reinforced polymer (FRP) construction. Manufacturer shall be of proven ability, and regularly engaged in the manufacture, fabrication and installation of FRP systems. FRP wet wells shall be manufactured from commercial grade polyester with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection system. Tank shall be manufactured by Steele Plastics LLC of Conway, Arkansas or Engineer approved equal.

B. Materials:

1. The resins used shall be a commercial grade unsaturated polyester resin.

2. The reinforcing materials shall be commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.

3. If reinforcing materials are used on the surface exposed to corrosive environments, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin rich surface.

4. Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

C. Fabrication:

Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show. The exterior surface of the wet well shall have a UV coating not less than .125".

1. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of grazing, delamination, and blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted up to 6 square feet if they are less than 3/4 inch in diameter and less than 1/16 inch deep.

2. The bottom of the wet well shall be built to withstand full exterior water column with a maximum deflection of 3/8". The anti-float flange shall be a minimum of 3" larger in diameter than the wet well and be constructed to withstand the maximum uplifting force that could be exerted with an empty wet well and full water column outside the tank.

3. Wet well shall be designed to withstand H-20 traffic loading when properly installed. Top flange shall be 3" larger in diameter than the interior diameter of the tank. Stainless steel threaded inserts shall be installed in the top flange of the basin/wetwell to accommodate attachment of covers. The inserts shall be 3/8" diameter in a 6-bolt pattern, 60° apart and secured using polyester resin to permanently hold in place.

4. Installation Of Stub-outs: Effluent, service, or discharge lines may be factory installed. Installation of stub outs to be fiberglass layup to comply with A.S.T.M.-D3299 specifications.
5. Fiberglass wet wells and basins may have an internal sloped fillet bottom. The fillet shall be constructed of the same fiberglass material as the wet well or basin and shall be integral to the wet well or basin. The fiberglass fillet shall have a 1:1 slope and shall not interfere with pump mounting in the wet well or basin.
6. Laminate cure shall be indicated by means of Barcol hardness measured in accordance with ASTM D2583. The average Barcol hardness shall not be less than 90% of the resin manufacturers recommendation for clear resin castings

7. The follow defects will be grounds for rejection of the product:

    a. Exposed fibers: glass fibers not wet out with resin.
    b. Resin runs: runs of resin and sand on the surface.
    c. Dry areas: areas with glass not wet out with resin.
    d. Delamination: separation in the laminate.
    e. Blisters: light colored areas larger than 1/2" in diameter or 1/8" in depth.
    f. Crazing: cracks caused by sharp objects.
    g. Pits or Voids: air pockets.
    h. Wrinkles: smooth irregularities in the surface.
    i. Sharp projection: fiber or resin projections necessitating gloves for handling.

D. Physical Requirements:

1. Load Rating: The complete wet well shall have a minimum dynamic-load rating of 16,000 ft-lbs. when tested in accordance with Section A.5. To establish this rating, the complete wet well shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs. and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 lbs.
2. The wet well shall comply with the physical properties of the following table:

	Hoop Direction	Axial Direction
Tensile Strength (psi)	18,000	5,000
Tensile Modules (psi)	$.8 \times 10^6$	$.7 \times 10^6$
Flexural Strength (psi)	26,000	4,500
Flexural Modules (psi)	2×10^6	1×10^6

E. Installation

1. Do not drop or impact the wet well. Wet wells shall be chocked if stored horizontally. If wet wells must be moved by rolling, the ground transversed shall be smooth and free of rocks, debris, etc. FRP wet wells may be lifted by the installation of two lifting lugs as specified by the manufacturer on the outside surface near the top or by a sling or "choker" connection around the center. Use of chains or cables in contact with the wet well surface is prohibited. Wet wells may be lifted horizontally using one support point.

2. Cutouts in wet well wall should be made with proper cutting tools, such as jig saw or hole saw. Do not use axe or other impact-type tools.

3. Bottom of excavation should be compacted to 95% Standard Proctor Density. Wet wells with diameters up to 54 inches and depths no greater than 12 feet, may be placed on a base of 6 inches of crushed stone. All other Wet wells, should have a poured reinforced concrete base at least one foot deep and at least two feet larger than fiberglass wet well outside diameter. The fiberglass wet well shall be lowered into the wet concrete and brought to plumb. For all wet wells, pour reinforced concrete over the anti-flotation flange sufficient to prevent floatation of fully submerged wet well.

2.2 PUMPS

A. General

1. Each lift station will be furnished with either a single pump (simplex) or two pumps (duplex) as listed on plans.

2. All pumps shall be designed for handling raw sewage and be of the grinder type.

3. The pump design shall allow for removal and reinstallation of the pump without the need for personnel to enter the confined space of the wet well and without the removal of bolts, nuts or other fasteners.

a. The pump shall connect to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load bearing type 304 stainless steel guide rails. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.
b. No part of the pump shall bear directly on the floor of the wet well.
c. The Contractor shall provide stainless steel wire rope of sufficient strength and length to properly and safely lift the pumps from the wet well. The working load of the lifting system shall be at least twice the pump unit weight.

B. The pumps shall be vertical, submersible, grinder type pump, designed to handle wastewater and clean water. The pumps shall be furnished as one complete pump system, all of the system components supplied by one manufacturer.

C. The pump unit shall be installed in the wet well when lowered into place on its mating discharge connection. The pump shall be easily removable along two stainless steel guide bars or cables for inspection or service. Guide mechanism on the pump shall be constructed of bronze, shall be non-sparking and U.L. Listed.

D. The pumps shall perform under the following operating conditions:

1. Pump Capacity as listed on plans
2. Maximum Allowable Pump Speed as listed on plans
3. Minimum Motor hp as listed on plans
4. Minimum Allowable Efficiency @ duty point – 20%

E. Pump Assembly Configuration

1. Rotation

a. The pump will be clockwise rotation when viewed from the driver end looking at the pump.

2. Impeller

a. Impeller shall be of the macerator type and matched to its constant velocity equalizing pressure volute and be made of close-grained cast iron conforming to ASTM A48 CL35B. It shall be an impeller of five vane construction, conform to the diameter specified on the plans, and shall macerate influent solids through the use of a two-bladed stationary cutter and impeller attached rotor.
b. The impeller is to be balanced and secured to the shaft by means of a bolt, washer, and key. The arrangement shall be such that the impeller cannot be loosened from torque in either forward or reverse rotation.
c. Wiper vanes on the back impeller shroud are not allowed.
d. Impeller shall be trimmed to specifically meet the conditions of operation.

3. Volute/Casing

a. Volute is to be cast with extra thick walls made of close-grained cast iron conforming to ASTM A48, Class 30. It is to be one-piece, constant velocity equalizing pressure with smooth fluid passages large enough to pass any size solid that can pass through the impeller.

b. A sliding bracket assembly shall be a part of the pumping unit constructed so that when lowered to the discharge base/elbow, the knifing action of the vertical metal-to-metal seal provides a self-cleaning, non-sparking UL Listed explosion-proof assembly.

4. Wear Rings

a. Wear rings shall be provided on both the impeller and fronthead so that clearances can be maintained throughout the life of the rings and minimize recirculation.
b. Impeller wear rings shall be of the axial- or face-type.
c. Fronthead wear rings shall be of the axial- or face-type.
d. Wear rings shall be attached to the impeller and fronthead using an interference fit and Loctite.
e. Wear rings shall be stainless steel, with the impeller wear ring approximately 50 Brinell softer than the fronthead wear ring.
f. Wear ring clearance adjustment shall be attained through impeller adjustment shims.

5. Guide Rail/Bracket

a. Two rails shall be provided to guide the pump when being raised or lowered in the sump and mount on the discharge base/elbow. Single rail or cable guide systems are not acceptable.
b. The rails shall align the pump with the discharge elbow as it is lowered into place.
c. A ductile iron upper rail guide bracket shall be furnished to support and align the rails at the top of the sump. For all rail lengths greater than 20 feet, a stainless-steel intermediate rail guide bracket shall be included.

6. Discharge Base

a. The installation shall include a rigid discharge base-elbow to support the total weight of the pumping unit.
b. The base is to be bolted directly to the floor with the 90-degree elbow having a 125 lb. ANSI flange discharging vertically.

7. Motor

a. Pumps shall be driven by completely sealed, electric submersible squirrel cage induction motors with a maximum NEMA nameplate rating compliant with the requirements shown on the plans.
b. Submersible equipment shall be UL Listed for Class I, Division 1, Groups C and D explosion-proof hazardous locations as defined by the National Electric Code. All electrical parts shall be housed in an air-filled cast iron, watertight enclosure which is sealed by the use of O-rings and rabbeted joints with extra large overlaps.
c. The stator windings shall be insulated with moisture resistant Class F insulation for continuous duty in 40°C ambient. The motor shall be designed for continuous duty capable to minimum of ten (10) starts per hour. Automatic reset, normally closed thermal overloads shall be imbedded in the motor windings to provide overheating protection. Motor winding thermostats shall be connected to an electric controller per state codes and the National Electric Code.
d. Motor shaft shall be one-piece type 416 stainless steel. The rotor and shaft together shall be dynamically balance to meet NEMA vibration limits. All external hardware shall be stainless steel.

e. Cable leads shall enter the top of the motor and shall allow the connection of a cable to the motor to be accomplished in the field without soldering cable. All leads are to be doubled sealed as it enters the motor to prevent cable-wicking to conduit box. The sealing system shall consist of a rubber grommet followed by an epoxy compound system that is high in adhesive properties and has a low coefficient of expansion. Each cable wire is to have a small section of insulation removed to establish a window area of bare wire and each wire is to be untwisted and surrounded by epoxy potting material. A cable strain relief mechanism shall be an integral part of this sealing system. Cable sealing system shall be capable of withstanding an external pressure test of 1200 PSI as well as a cable assembly pull test as required by Underwriters Laboratories. Each motor shall be supplied with 50 feet of multi-conductor type "SOW-A" or "W" power cable and control cable. Cable sizing shall conform to NEC specifications and be UL Listed.

f. Power and control leads shall be terminated on a sealed terminal board. The terminal board and its bronze lugs shall be O-ring sealed.

8. Shaft Seal Arrangement

a. Pump(s) shall be provided with two separate tandem-mounted mechanical seals to prevent the pumped liquid from entering the rotor/stator cavity area to ensure reliability of operation. The upper and lower seals are mounted to rotate in the same direction.

b. The lower mechanical seal mating surfaces are to be immersed in an oil bath, sealing the pump volute chamber from the oil cavity. Oil in this cavity shall also lubricate the upper mechanical seal faces. Seal faces of both the upper and lower mechanical seals shall be held in contact by independent polymeric elastomer bellows, which act as a spring mechanism. Seals require neither maintenance nor adjustment, but shall be easily inspected and replaced. Pressure generated by the pump assists in sealing the mating surfaces of the lower seal.

c. Component material for the upper seal shall consist of a composite elastomer body, carbon steel snap ring, Buna-N O-ring, carbon rotating face and ceramic stationary face. Lower seal component construction shall include a composite elastomer body, stainless steel clamp and set screws, Buna-N O-ring, silicon carbide rotating face and tungsten carbide stationary face.

d. Two moisture detection probes shall be installed so that they will detect moisture in either the seal or stator cavity measuring resistivity between the probes. They shall be wired internally to the control cable connection at the top of the motor. Float type devices located in the rotor/stator area or single probe-to-ground moisture detectors measuring continuity are not acceptable. O-ring sealed inspection plugs shall be provided in the mechanical seal oil chamber for ease of inspection, draining and filling of oil.

9. The pump shall rotate on a grease lubricated-for-life thrust bearing and grease lubricated radial bearing with a minimum L10 life of 100,000 hours. Lower shaft bearings shall be locked in place to prevent shaft movement and to take thrust loads.

10. Fits and Hardware

a. All machined bolts, nuts, and capscrews shall be stainless steel and be of the hex-head type that will not require the use of any special tools.

b. A heavy-duty stainless steel lifting bail shall be included and be of adequate strength to lift the entire pump and motor assembly.

F. Manufacturers

1. Subject to compliance with the requirements, provide products by one of the following manufacturers:

    a. Sulzer Ltd
    b. Gorman Rupp Pump Company
    c. Keen Pump Company

2.3 PIPING AND VALVES

A. General

1. Lift station shall be pre-piped by supplier. Valves shall be located within the wet well.

B. Piping

1. Piping within wet well shall be type 316 stainless steel unless otherwise noted on the drawings. Stainless steel pipe and fitting dimensions and materials shall conform to MSS-SP-114, Class 150 or Class 1000 as noted. Pipe threads shall conform to ASME B1.20.1. General dimensions for stainless steel flanges shall conform to MSS-SP-51. Dimensions of flange bolt hole and circle diameters shall conform to ANSI B16.5.

C. Emergency Bypass Piping

1. All lift stations shall have 4" stainless steel bypass piping with camlock for emergency draw down via portable pump. Bypass piping camlock shall be readily accessible inside wet well hatch, but shall not obstruct entry or exit into wet well or interfere with pump guide rail system.

D. Vent

1. All lift stations shall have a 4" stainless steel vent with screen sufficient to keep out insects and wildlife

2.4 PUMP CONTROL PANEL

A. General

1. The pump control panel enclosure shall be strut support-mounted UL-listed, NEMA 4X stainless steel rated for outdoor use, and pad lockable. Enclosure shall have 3-point latching mechanism and handle for easy release. Enclosure shall not require clasps around the door to maintain a NEMA 4 rating. Enclosure shall be manufactured by Hammond, Hoffman, Rittal, or approved equal and shall be adequately sized to accommodate equipment furnished. The enclosure shall also provide for "dead-front" construction using hinged inner doors (swing out panel) to mount all operator devices. Bond all panels and panel doors to ground system. Hinges shall not be considered as an adequate grounding path. All hardware shall be corrosion resistant.

2. The panel manufacturer shall be a current Underwriters Laboratories listed UL 508 industrial control panel builder and shall show its follow-up service procedure file number on submittals. All devices within the panel shall be UL-listed and/or recognized where applicable and shall be mounted and wired in accordance with the most current edition of UL 508 and the NEC. All conduit runs entering or leaving the pump station wet well shall

have explosion-proof conduit seals suitable for Class I, Division 1, Group D environment. All conduits for intrinsically safe wiring shall enter the pump control panel enclosure at the intrinsically safe section of the panel. Non-intrinsically safe wiring including, but not limited to, power feeder conductors, branch circuit conductors, alarm circuits, and pump motor cables shall not enter the control panel at the intrinsically safe wiring section and shall maintain a minimum separation distance inside the control panel from the intrinsically safe conductors as required by NEC 504 and ANSI/ISA RP12.6.

3. All conduit entries into the Pump Control Panel shall have water-tight threaded hubs, UL-listed for the respective NEMA 4X enclosure.

4. Include a label placed on the inside of the panel door with the name, address, phone number and emergency phone number of the service representative for the pumps and control panel.

5. Contractor shall furnish all equipment, labor, services, submittals, tools and work required to provide a complete and operational Pump Control Panel as shown on the Plans and specified herein.

6. The pump control panel enclosure shall be located adjacent to proposed pump station as detailed on the Plans. Furnish and install stainless steel strut support (Unistrut P1000SS or approved equal), and all mounting hardware. Include warning label on inner and outer door labeled "WARNING POTENTIAL ELECTRIC ARC FLASH HAZARD, DISCONNECT FEEDER BREAKER BEFORE SERVICING", or similar note conforming to the requirements of NEC 110.16 "Flash Protection." Warning label shall also conform to ANSI Z535.4-2002 "Product Safety Signs and Labels."

B. Control Description

1. A microprocessor-based pump controller shall be provided to monitor wet well level via floats as specified elsewhere and provide pump down mode pump control. The pumps shall start and stop as required to maintain an acceptable level.
2. For duplex lift stations, if the capacity of the lead pump is less than the influent flow, the lag pump shall be called to start. If the capacity of both pumps running in parallel is greater than the influent flow, the pumps shall stop when the wet well level falls to STOP setpoint.

3. If the capacity of the lead pump is greater than the influent flow, it shall stop when the level falls to the STOP setpoint. The pumps shall alternate after each complete operating cycle if alternation is enabled.

4. The pump control panel shall include the following described equipment (installed complete and operational), as well as that shown on the Plans and specified herein.

C. Components

1. Power Distribution Blocks: Each power distribution terminal block shall be provided with a clear plexiglass cover. Terminal block shall be Square D Class 9080, or approved equal sized as required for the respective conductors. All terminal blocks shall be rated 600 volt with amperage ratings in conformance with NEC Table 310-16 using 75oC wire for the respective lug wire range.

2. Secondary Surge Protector: AC surge protector shall be UL listed per UL 1449, third edition and status indication lights, Joslyn 1450-49 or approved equal.

3. 2 KVA Control Power Transformer: Control transformers and power supplies shall be provided to provide the 120 VAC and/or 24 VAC for control circuits when required. Transformers shall have circuit breaker over current protection on the primary and secondary circuits. The secondary windings shall be grounded. Control Power Transformers larger than 2 kVA shall be externally mounted on the control side of the enclosure and shall be supplied in a NEMA 4X stainless steel nonventilated weatherproof housing. Primary and Secondary Protection shall be provided for transformer. The overcurrent protection shall be achieved with fuses. The control power transformer shall Square D Type T, TF or approved equal.

4. Circuit breakers: Circuit breakers for motor circuits, control circuits, and other branch circuits shall be thermal magnetic, molded case, 100-Amp frame minimum, 10,000 Amps symmetrical, interrupting current rating at 120/240 VAC for one-pole and two-pole breakers and 10,000 Amps symmetrical, interrupting current rating at 240 VAC for three-pole breakers as manufactured by Square D, or approved equal. Breakers shall have "on", "off" and "tripped" positions and shall be UL-listed. Breakers shall be sized as required for the respective equipment in accordance with NEC and the respective equipment manufacturer's recommendation. Include breakers for the following equipment as a minimum.

    a. Pump motor #1 branch breaker.
    b. Pump motor #2 branch breaker.
    c. Pump control panel control circuit.
    d. Accessories (GFCI receptacle, and heater)
    e. Alarm System

5. Reduced Voltage Solid State Starter (RVSSS):

    a. This specification guide describes the required performance, functional specification, fabrication details and installation of a microprocessor controlled low voltage soft-starter, used for step-less start and stop as well as protecting of standard AC squirrel cage induction motors.
    b. The soft-starter shall be ABB Type PSE Series, Cutler Hammer S 811 or pre-approved equal. The soft-starter must contain at least the features, functions and adjustments described below, in order to provide the motor and application with sufficient protection, and start and stop the motor in a precise and controlled manner.
    c. Operator Interface HMI: The starter shall be operated with an LCD display presenting all data and information using a language neutral icons and figures. All numbers shall be presented using four positions, seven segments. The use of binary, hexadecimal code, or any other code is not acceptable and currents and measurements shall be presented as either exact values or as a percentage of the maximum value. Adjustments shall be made by a digital four push button keypad. No binary coded dipswitches shall be used for programming or function selection. The HMI shall be possible to lock to prevent unauthorized changes to the programming. Data should always be presented with as the actual value, and the unit of the data (i.e. V, A or % etc). Data entered and selections made to the soft-starter using the display and keypad should be stored in case of a power loss. LED Indicators using long life LEDs shall provide additional quick annunciation of;

6. Mode Select: method of operation shall be by a three-position maintained "Hand-Off-Auto" selector switch provided for each pump. Selector switch shall be water-tight/oil tight

(NEMA 4/13) Allen Bradley 800T Series, Square D Class 9001, Type K, or Cutler-Hammer E22 or Cat. No. 10250 Series. Position commands are as follows:

a. Hand – In this position, the applicable pump shall run without regard for the level sensing commands and will relay on operator discipline to run and stop.
b. Off – In this position, the applicable pump will not run under any circumstances.
c. Auto – in this position, the float switches and respective control relays shall control the applicable pump. The float switches will sense the appropriate levels in the wet well and initiate start and stop commands to the pump through the associated control relays.

7. Legend Plates: Legend plates shall be required for all starters, circuit breakers, control panels, and disconnects. Legend plates shall be provided to identify the equipment controlled and the function of each pushbutton, indicating light, pilot light, selector switch and device. Legend plates shall be weatherproof and abrasion resistant phenolic materials. Lettering shall be black on white background, unless otherwise noted.

8. Condensation Heater: Provide a condensation strip type heater sized as required for the pump control panel enclosure to minimize moisture that may accumulate inside the enclosure. Heater shall be sized to maintain a minimum internal enclosure temperature of approximately 50°F for an outside design temperature of -15°F. Include integral thermostat and circulating fan for condensation heater. Circulating fan shall be 4 in. to 6 in. nominal diameter axial type fan with wire guards, 115 VAC, 60 Hz. Thermostat shall be line voltage thermostat, 120 VAC, 5-amp minimum current rating, SPST, with adjustable control knob as manufactured by Honeywell, White-Rogers, Hammond, Hoffman, Rittal, or Chromalox.

9. Convenience Duplex Receptacle: Provide a duplex receptacle with ground fault circuit interrupter. Receptacle shall be rated 120 VAC, 60 Hz, and 15 Amps with a trip threshold of 5±1 milliamp. Receptacle shall be a UL Class A GFCI unit complying with and tested in accordance with UL Standard No. 943. GFCI shall be as manufactured by Leviton, Hubbell, Eagle, Arrow-Hart, Bryant, or Pass & Seymour.

10. Pump Motor Thermal Trip: A thermal trip on the motor will cause immediate shutdown and activate the respective thermal trip condition alarm. Pump motor thermal trip shall be wired to provide manual reset and restarting of the pump motor in conformance with the recommendations of the respective submersible pump manufacturer's representative. Provide interposing relays as required. Verify thermal trip requirements with the respective submersible pump manufacturer.

11. Pump Motor Seal Leak Detection: The seal leak detection on the motor shall shut down the pump and activate the respective seal leak alarm as required/recommended by the respective submersible pump manufacturer's representative.

    a. Provide interposing relays as required. Verify seal leak requirements with the respective submersible pump manufacturer.

12. Motor Monitor Relays: Motor monitor relay shall be provided by the pump vendor or be a model approved by the pump vendor to ensure the pump warranty is maintained.

13. Enclosure Light: Provide a 60-watt incandescent light fixture or equivalent for the pump control panel enclosure with door activated switch. Light fixture shall be Hoffman Catalog Number A-LTDB1, or approved equal. Include lamps for respective fixture.

14. Construction Standards

a. Wire Numbers – Each wire in the control panel shall be marked with a wire number that corresponds to the page and ladder rung of the schematic diagrams. A unique wire number shall be provided between component contacts and coils. Wire markers shall be Brady Thermal Transfer Self-Laminating Vinyl or equal by Grafoplast or Thomas & Betts.

b. Color Coding – Wires shall also be color-coded as follows: 120 VAC Line = black; Neutral = white; Ground = green; Switched 120 VAC = red; DC current carrying conductor = blue, DC non-current carrying conductor = white with blue stripe, Foreign voltage = yellow, Intrinsically safe = light blue.

c. Component Identification – Each component in the system shall be identified by a unique number that corresponds to its coil's page and ladder rung location on the schematic drawings.

d. Wire – AC control conductors shall be 600 volt and a minimum of 18 gauge. DC control conductors shall be a 300-volt and a minimum of 18 gauge. Control conductors shall be UL Type MTW rated for 105o C. Analog conductors shall be 22 gauge shielded twisted three conductor rated for 300 volts. Wire shall be Beldon 8771 or equal. Shields shall be grounded at the PLC or panel location. Power conductors shall be sized per UL and NEC standards and rated for 600 volts. Conductors shall be UL Type MTW, THHN or THWN rated for 90o C.

e. Control Terminals – All field control conductors shall be connected to terminal blocks. Terminals shall have machine marked wire numbers. Connection of field control conductors directly to control panel components will not be allowed. Terminal blocks shall be rated for 30 amps at 600 volts. They shall be screw terminal type capable of terminating 10 to 26 gauge wire. Terminal bridge bars shall be provided when it is necessary to bridge multiple like terminals together. Terminals and accessories shall be Phoenix Contact "Clipline" or equal by Allen Bradley or Weidemueller.21.

f. Provide one box (5 minimum quantity) of each type and size of fuse, upon completion of the job, for use as spares.

g. A schematic diagram (showing wire color) shall be permanently fastened to the inside of the enclosure. An Installation and Service Manual shall also be included with each control panel. The control panel shall be U.L. listed as an assembly.

15. Level Controller

a. General

1) The Lift Station Controller shall be an off-the-shelf, preprogrammed, dedicated to the application, microprocessor based controller capable of monitoring process variable inputs and automatically control up to three constant speed pumps. Systems using a one-of-a-kind, non-standardized, custom programming generic controller represent additional complexity and unproven operation and thus are not in conformance to the intent of the these specifications and will not be acceptable.

2) Controller shall be configured for the number of pumps to be controlled at this lift station as per these specifications.

3) The operator interface shall display the current level in feet and represent the level in bar graph form, which dynamically updates based on the level in the wet well.

4) An active/dynamic graphical representation of each pump and its status shall be displayed on the same screen along with flow in gallons per minute. Pump

graphic shall change state to indicate – "Off", "Called", "Running", and "Failed/Out of Service".

5) Touching an active pump on the home screen shall move the display to the respective pump status screen.
6) A trend screen showing no less than the last 2 hours of wet well level fluctuations shall be available.
7) The operator interface shall have a display area not less than 3.5" with 160 x 128 pixel resolution, Transflex touch screen graphic display viewable in direct sunlight.
8) The operator interface shall be suitable for Type 12, 4 & 4X environment. Additionally, the display shall be manufactured from a UV resistant polyester substrate.
9) To prevent the loss of data during a power outage longer than 4 hours, the controller shall have a built-in replaceable battery system to keep volatile memory active for approximately 10 years.

b. Inputs & Outputs – The controller shall come standard with herein specified inputs and outputs. The controller shall also have the ability to accommodate additional expansion I/O without the need to replace hardware or upgrade the controller. The controller shall be configured to monitor the following discrete input status signals:

1) Pump 1, 2 Running
2) Pump 1, 2 HOA In Auto
3) Pump 1, 2 Seal Failure
4) Pump 1, 2 Overtemperature
5) Pump 1, 2 Overload
6) Backup Active
7) High Level Float
8) Low Level Float
9) Control Power Failure
10) Generator Running
11) Phase Failure
12) Station Intrusion
13) Flow Pulse
14) Temp Alarm High/Low

c. The controller shall provide the following discrete output signals:

1) Pump 1, (and 2 if duplex) Call
2) Pump 1, (and 2 if duplex) Failure
3) Common Alarm
4) Alarm Horn
5) Alarm Horn Silence
6) Backup Reset

d. The controller shall monitor the following (4-20 mA) process signals:

1) Wet Well Level

e. A two-level security system shall be provided for operators (OPER) and supervisors (SUPER). Without being logged in, screens are view only.

1) OPER – Operator Access

a) Rights to edit set points and acknowledge alarms

2) SUPER – Supervisor Access

a) All privileges as the OPER
b) Right to change the passwords of both SUPER and OPER users
c) Right to set lifetime pump runtime and start totals
d) Right to toggle communication ports between telemetry communications or local programming modes
e) Right to set the controller time and date
f) Right to access removable media system screen
g) Shall be provided with factory default passwords
h) To prevent unauthorized controller adjustments, an adjustable 0-999 second delay shall be provided to automatically logoff the current user after the adjustable time period, and no operator screen navigation has been detected.

f. The controller shall be capable of operating pumps in an automatic or fixed mode. In automatic mode, a built-in alternator shall be available to equalize motor starts, stops and run time. The alternator shall have the capability of being put into fixed sequence mode at any time. Alternation shall also have the capability to alternate cyclically or following an adjustable period of time.

g. Alternation (For

1) Alternator shall have pump fail replace logic allowing a failed pump to be detected and the lag pump to be called into service without level increasing to lag start setpoint.
2) Auto Alternation Mode

a) If the running signal input is not received within 60 seconds (adjustable) of the respective pump being called to start, a pump failure alarm shall be displayed in the alarm banner and the next pump in sequence shall be called to start.

3) Fixed Alternation Mode

a) If the running signal input is not received within 60 seconds (adjustable) of the respective pump being called the respective pump shall continue to be called until the level in the wet well reaches the next level setpoint at which point the next pump in the sequence shall be called to start.

h. Setpoints

1) The following system setpoints shall be provided: (* indicates an associated, user adjustable (0-999) seconds time delay shall also be provided to prevent momentary process fluctuations from impacting alarm or control.) For simplex lift stations, omit pump 2 and lag pump setpoints

a) Wet Well Level High and Low Level Alarm * elevation as shown on drawings.
b) Start Lead*, Lag 1* elevation as shown on drawings
c) Stop Lead*, Lag 1*, elevation as shown on drawings.

d) Pump 1, 2 Failure to Start Delay xxx sec
e) Pump 1, 2 Seal Failure Delayxxx sec
f) Pump 1, 2 Over Temp Delay xxx sec

i. Alarms

1) The controller shall monitor, display and log the following alarms:

a) High or Low Wet Well Level Alarm (Transducer)
b) Pump 1, 2 Seal Failure
c) Pump 1, 2 Over Temp
d) Pump 1, 2 Overload
e) Pump 1, 2 Failure (internal to controller, Call No Run)
f) Float Backup Active
g) Low Level Cutout (from floats)
h) High Level Alarm (from floats)
i) Control Power Failure
j) Generator Running
k) Phase Failure

j. Pump Status

1) The controller shall have Pump Status screens that provide the following information and control options:

a) Pump 1, 2 Status (Off, Called, Running, & Failed)
b) Pump 1, 2 Hard and Soft H-O-A Status
c) Pump 1, 2 Seal Failure Status
d) Pump 1, 2 Over Temp Status
e) Pump 1, 2 Overload Status
f) Today: Pump 1, 2 Runtime xx.x Hours
g) Today: Pump 1, 2 Starts xxx
h) Yesterday: Pump 1, 2 Runtime xx.x Hours
i) Yesterday: Pump 1, 2 Starts xxx
j) Current (CRNT) Month (MNTH): Pump 1, 2 Runtime xxx.x Hours
k) Current (CRNT) Month (MNTH): Pump 1, 2 Starts xxx
l) Last Month (MNTH): Pump 1, 2 Runtime xxx.x Hours
m) Last Month (MNTH): Pump 1, 2 Starts xxx
n) Total: Pump 1, 2 Runtime 999999.9 Hours
o) Total: Pump 1, 2 Starts 999999

k. Navigation – A menu system shall be provided for the user with proper access to change setpoints, setup pump starts, stops, alarms, alarm delays and setup pump alternation. The following parameters shall be provided:

1) Level and Level Delay Setpoints
2) Alternation – Auto or Fixed mode; Timed or Cyclical (Duplex stations only)
3) The operator shall have a choice of selecting automatic or a fixed sequence.
4) Pump Failure – call, no run
5) The user shall be able to enter pump failure time for each pump that is enabled. A failed pump will be replaced with the next available pump.
6) Seal Failure and Over Temp

7) The user shall be able to enter seal failure and over temp time delays for each respective pump that is enabled.
8) Miscellaneous Alarms
9) The user shall be able to enter delays for communications failure, intrusion and high or low temperature.
10) A field shall be provided to scale the transducer in feet to setup the vertical scale on the Home screen and an adjustable offset in feet, shall be provided to compensate for the transducer to be raised off the bottom.

2.5 FLOAT SWITCHES

A. General

1. The level sensing devices shall be 5½" diameter, 316 stainless steel float switches.
2. Float shall have a SPDT mercury-free switch, rated 25 W at 125 VAC with mechanical life of 10 million operations.
3. The float cable shall be rated "continuous service" for high flexibility.
4. The float switches shall be pipe mounted as shown on the drawings. All mounting hardware shall be 316 SS. All cable fittings shall be flared and incorporate strain relief jacketing. Pipe mounting clamps shall be furnished by the float manufacturer.
5. Float switch shall be Contegra Model FS-90 and shall have a three-year warranty. Float switch shall be furnished in quantity, cable lengths, and with accessories as shown in the plan drawings.

PART 3 - EXECUTION

3.1 INSTALLATION AND TESTING

A. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.2 FIELD QUALITY CONTROL

A. Operational Test

1. An operational test of all pumps and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.
2. After construction debris and foreign material has been removed from the wet well, Owner shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, pressure gauge readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

3. Submit written report of test results to the Engineer including, at a minimum, measured flow rates, discharge head and ampere draw for each phase.

B. Manufacturer's Start-up Services

1. Co-ordinate station start-up with manufactures technical representative. The representative or factory service technician will inspect the completed installation. He or she will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.3 WARRANTY

A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur.

END OF SECTION 333217

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART - 1 GENERAL

1.1 SUMMARY

A. Provide storm sewerage system in accordance with provisions of the Standard Specifications for Highway Construction, Missouri Department of Transportation as shown on the Drawings, and as specified herein.

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 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.

1.5 UTILITIES AND DRAIN TILES

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 811 and the Owner or his/her site representative 48 hours prior to start of work.

C. 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.

D. An attempt is made to indicate or show accurate location of all underground utilities or drain tiles 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 and drain tiles 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.

E. 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 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.

F. Wherever underground utilities or drain tiles 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.

G. Where existing underground utilities or drain tiles are in conflict 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."

PART - 2 PRODUCTS

2.1 PIPING MATERIALS

A. Reinforced Concrete Pipe (RCP):

1. Comply with ASTM C 76.
2. Minimum Class III and as specified in Section 1026 of the Standard Specifications.
3. Use tongue and groove joints wrapped with engineering fabric, unless a rubber O-ring or profile gasket complying with ASTM C 443 is specified.

B. Polyvinyl Chloride Pipe (PVC):

1. Solid wall PVC Pipe complying with ASTM D 3034 or ASTM F 679.
2. PVC plastic meeting ASTM D 1784, Cell Classification 12454.
3. SDR 26: Minimum pipe stiffness of 115 psi (pipe 4" to 15" diameter).
4. Pipe stiffness per ASTM D 2412, 46 psi (pipe 18" to 27" diameter).

C. High Density Polyethylene Pipe (HDPE):

1. AASHTO M 294, Type S corrugated exterior and smooth interior.
    a. 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. ASTM D 3350 minimum resin Cell Classification 335420 C.
3. Minimum pipe stiffness at 5% deflection according to ASTM D 2412.
4. Integral bell and spigot joints with elastomeric seals complying with ASTM F 477.
5. Maximum 5% deflection of the average inside diameter by testing after installation by pulling 9 arm deflection mandrel, complying with applicable ASTM Standards, through sewer by hand.

D. Corrugated Metal Pipe (CMP):

1. AASHTO M 36, Type I.
2. Zinc coating complying with AASHTO M 218.
3. Corrugated steel circular section with annular or helical corrugations.
4. Gauge of pipe according to MoDOT Specifications Section 725.1.3.1.
5. Coupling bands with annular or helical corrugations to match pipe ends.

E. Pipe Drains, Underdrains and French Drains:

1. Comply with Section 605 of the Standard Specifications for the type, class, and size of pipe drains

2.2 MANHOLES, INLETS AND DRAINAGE STRUCTURES

A. Manholes, Inlets, and Drainage Structure:

1. Manholes materials shall be per Section 330513 Manholes and Structures in of these specifications and details in the Drawings. Pipe stubs when specified for future connections shall consist of a one-foot section of belled pipe of the specified diameter inserted in a watertight connection and an airtight plug.

B. PVC Drainage Structure:

1. Nyloplast drain basins and grates
2. Approved Equal Product

C. Cast in Place Concrete:

1. Concrete: Use Class B1 concrete. Comply with the following MoDOT Specifications.

D. Non-Shrink Grout

1. Comply with MoDOT Section 1066 of the Standard Specifications.

E. Granular Foundation:

1. Granular foundation material shall be gravel or crushed stone sized primarily within a 1” to maximum 3” range. Quality shall consist of sound durable aggregate particles reasonably free of objectionable deleterious materials.

F. Bedding, Haunching and Backfill:

1. Bedding, Hauching and Backfill material as specified in Section 312333 Trenching and Backfilling.

G. Select Granular Backfill:

1. Select granular backfill shall be a Type 5 Aggregate material per MoDOT specifications, except the quality may be Grade D and up to 15% fines passing the #200 sieve will be allowed.

2.3 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains as shown on the Drawings.

B. Make connections to existing piping and underground manholes.

1. New connection

a. Use commercially manufactured wye fittings for piping branch connections with sizing as show in the plans.

2. Connection to Existing Storm Sewer

a. Use commercially manufactured wye or insertable tee fittings to the existing piping. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete complying with Class B1 concrete, or install insertable tee per manufacturer’s recommendations.

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

A. Excavation and backfilling for sewers, collection lines, 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.

B. Connections of dissimilar types of pipe when joined outside of a manhole or other structure shall be joined with suitable adapters, such as:

1. Fernco Flexible Coupling, Fernco, Inc. (Davison, Michigan).
2. Flexi-Seal Coupling, Mission Rubber Co. (Corona, California).
3. Approved equal.

C. Foundations and Bedding:

1. All sewer pipe shall be laid on an aggregate bedding, having a minimum thickness of 4 inches below the pipe and extending to the midpoint of the pipe as shown on the Drawings.
2. Compaction requirements for foundation, bedding and haunching shall be based upon the material utilized in accordance with the Section 312333 “Trenching and Backfilling” of these Specifications.

D. Gravity Storm Sewer Installation:

1. Clean pipe interior and joints prior to installation. Keep pipe clean during construction.
2. Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless otherwise specified.
3. Use a saw to cut ends of pipe flush with inside wall of manholes and structures. Do not use hammer or other means to break pipe.
4. Provide manholes as specified in the contract documents.
5. Clean joint surfaces to remove soil or foreign material prior to jointing pipe. Assemble joints according to pipe manufacturer’s recommendations. Use equipment that does not apply damaging forces to pipe joints.
6. Install cap, plug, or bulkhead at exposed ends of pipe upon completion of construction or whenever pipe installation is not in progress.

E. Backfilling Trenches:

1. Compaction requirements for trench backfill shall be based upon the material utilized in accordance with the Section 312333 “Trenching and Backfilling” of these Specifications and as shown on the plans.
2. After sewers are laid and bedded in an open cut, the trench shall be backfilled to the planned ground surfaces. Unless otherwise permitted by the regulatory authority, not more than three hundred (300) feet of completed pipe shall be left without backfill.
3. In all backfill types, trench shields, sheeted sections and bracing shall in no case be withdrawn before the trench is sufficiently filled to prevent personal injury, or collapse of trench walls, banks, road surfaces, adjacent utility structures, sidewalks or other property, public or private.
4. When PVC pipe is utilized, select granular initial backfill at least twelve (12) inches above the top of the pipe shall be placed utilizing the same type of material used for haunching.

F. Sewer Pipe and Water Main Separation:

1. Horizontal and Vertical Separation of Gravity Sewers from Water Mains shall be in accordance with Missouri DNR Specification.

3.3 FIELD QUALITY CONTROL

A. The **Owner** will provide testing services of a soils engineer and/or independent laboratory for this project. Trenching and backfilling testing shall be completed in accordance with Section 312333 “Trenching and Backfilling” of these Specifications

END OF SECTION 334100

SECTION 334101 - SANITARY SEWERAGE SYSTEM

PART - 1 GENERAL

1.1 SUMMARY

A. Provide sanitary sewerage system in accordance with provisions of the Standard Specifications for Highway Construction, Missouri Department of Transportation as shown on the Drawings, and as specified herein.

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 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.

1.5 UTILITIES AND DRAIN TILES

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 811 and the Owner or his/her site representative 48 hours prior to start of work.

C. 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.

D. An attempt is made to indicate or show accurate location of all underground utilities or drain tiles 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 and drain tiles 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.

E. 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 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.

F. Wherever underground utilities or drain tiles 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.

G. Where existing underground utilities or drain tiles are in conflict 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."

1.6 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.

B. 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.

C. All grassed surface areas shall be replaced to a condition equal to that found prior to the start of work.

D. Erosion control measures shall be installed in accordance with Section 312513 Erosion Control of these Specifications.

E. 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 PIPE MATERIALS FOR SEWERS

A. Sewer pipe shall comply with provisions of these specifications for the type, class, strength, coatings and linings of the pipe as shown on the Plans and as described herein:

1. HDPE Pipe (Fusible) 2” TO 12” diameter:

    a. Material Designation Code: PE4710 and Comply with AWWA C906 with ductile iron pipe equivalent outside diameters.
    b. Minimum Wall Thickness: **DR 9**
    c. Provide pipe extruded with plain ends square to the pipe, free of any bevel or chamfer, and without bells or gaskets of any kind

2. Polyvinyl Chloride (PVC) Pipe 4" to 15" diameter:

    a. Dimensions of pipe and fittings shall conform to ASTM D3034.
    b. Minimum acceptable Standard Dimension Ratio (SDR) shall be 26.

        1) SDR 26: Minimum pipe stiffness of 115 psi.

    c. PVC plastic meeting ASTM D 1784, Cell Classification 12454 or 12364.

3. Polyvinyl Chloride (PVC) Pipe for trenchless installation:

    a. Dimensions of pipe and fittings shall conform to ASTM D3034.
    b. Minimum acceptable Standard Dimension Ratio (SDR) shall be 26.

        1) SDR 26: Minimum pipe stiffness of 115 psi.

    c. PVC plastic meeting ASTM D 1784, Cell Classification 12454 or 12364
    d. Integral Restrained Joint: AWWA C900 pipe with restraining system manufactured integrally into pipe end.

4. Polyvinyl Chloride Pipe (PVC) 18” to 27” diameter:

    a. Dimensions of pipe and fittings shall comply with ASTM F 679.
    b. Pipe stiffness per ASTM D 2412, 46 psi.
    c. PVC plastic meeting ASTM D 1784, Cell Classification 12454 or 12364.

B. Joints:

1. PVC Pipe joints for ASTM 3034 and ASTM 679 pipe shall be flexible elastomeric seals per ASTM D 3212 and ASTM F 477 or solvent welded joints per ASTM D 2855 for 4" and 6" only.

2. HDPE butt fusion fittings shall have a manufacturing standard of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records. All fittings shall be suitable for use as pressure conduits, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

C. Manholes:

1. Manholes materials shall be per Section 330513 Manholes and Structures in of these specifications and details in the Drawings. Pipe stubs when specified for future connections shall consist of a one-foot section of belled pipe of the specified diameter inserted in a watertight connection and an airtight plug.

D. Cast in Place Concrete:

1. Concrete shall be in accordance with Section 311313 Concrete Site Work of these specifications

E. Non-Shrink Grout

1. Comply with MoDOT Section 1066 of the Standard Specifications.

F. Granular Foundation:

1. Granular foundation material shall be gravel or crushed stone sized primarily within a 1" to maximum 3" range. Quality shall consist of sound durable aggregate particles reasonably free of objectionable deleterious materials.

G. Bedding, Haunching and Backfill :

1. Bedding, Haunching and Backfill material as specified in Section 312333 Trenching and Backfilling.

H. Select Granular Backfill:

1. Select granular backfill shall be a Type 5 Aggregate material per MoDOT specifications, except the quality may be Grade D and up to 15% fines passing the #200 sieve will be allowed.

2.2 CONNECTIONS

A. Connect nonpressure, gravity-flow sewage piping to building's as shown on the Drawings.

B. Make connections to existing piping and underground manholes.

1. New connection

a. Use commercially manufactured wye fittings for piping branch connections with sizing as show in the plans.

2. Connection to Existing Sanitary Sewer

a. Use commercially manufactured wye or insertable tee fittings to the existing piping. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete complying with Class B1 concrete, or install insertable tee per manufacturer's recommendations.

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

A. Excavation and backfilling for sewers, collection lines, 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.

B. Connections to Existing Manholes shall be completed in Standard Specifications, and details in the Drawings.

C. Connections of dissimilar types of pipe when joined outside of a manhole or other structure shall be joined with suitable adapters, such as:

1. Fernco Flexible Coupling, Fernco, Inc. (Davison, Michigan).
2. Flexi-Seal Coupling, Mission Rubber Co. (Corona, California).
3. Approved equal.

D. Foundations and Bedding:

1. All sewer pipe shall be laid on an aggregate bedding, having a minimum thickness of 4 inches below the pipe and extending to the mid point of the pipe as shown on the Drawings.
2. Compaction requirements for foundation, bedding and haunching shall be based upon the material utilized in accordance with the Section 312333 “Trenching and Backfilling” of these Specifications.

E. Gravity Sewer Installation:

1. Install watertight plug to prevent water from entering the existing sewer system.
2. Clean pipe interior and joints prior to installation. Keep pipe clean during construction.
3. Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless otherwise specified.
4. Use a saw to cut ends of pipe flush with inside wall of manholes and structures. Do not use hammer or other means to break pipe.
5. Provide manholes as specified in the contract documents.
6. Clean joint surfaces to remove soil or foreign material prior to jointing pipe. Assemble joints according to pipe manufacturer’s recommendations. Use equipment that does not apply damaging forces to pipe joints.
7. Install cap, plug, or bulkhead at exposed ends of pipe upon completion of construction or whenever pipe installation is not in progress.

F. Tees and Laterals:

1. Unless otherwise specified, tees and laterals shall be of the same type and strength material as the main sewer pipe.
2. Lateral pipes and connecting tees or saddles shall be six-inch unless otherwise specified and shall be installed at locations shown on the Plans.
3. Sewer laterals shall be installed at right angles to the sewer main. Trenching and backfilling laterals shall comply with the same requirements as the main sewer pipe it joins. Open ends of laterals or tees shall be closed with air tight plugs which can readily be removed at a later date without breaking the lateral pipe or tee, if required.
4. The Contractor shall be responsible for installing laterals to the depth shown on the Plans.
5. Contractor shall locate tees and ends of laterals by field measurements from manholes and main sewer and submit a record of locations to the Engineer.

G. Backfilling Trenches:

1. Compaction requirements for trench backfill shall be based upon the material utilized in accordance with the Section 312333 "Trenching and Backfilling" of these Specifications and as shown on the plans.
2. After sewers are laid and bedded in an open cut, the trench shall be backfilled to the planned ground surfaces. Unless otherwise permitted by the regulatory authority, not more than three hundred (300) feet of completed pipe shall be left without backfill.
3. In all backfill types, trench shields, sheeted sections and bracing shall in no case be withdrawn before the trench is sufficiently filled to prevent personal injury, or collapse of trench walls, banks, road surfaces, adjacent utility structures, sidewalks or other property, public or private.
4. When PVC pipe is utilized, select granular initial backfill at least twelve (12) inches above the top of the pipe shall be placed utilizing the same type of material used for haunching.

H. Trenchless installation:

1. Select a method of installation that is appropriate for the soil conditions anticipated and will 1) allow the pipe to be installed to the desired line and grade within the specified tolerances; 2) prevent heaving or settlement of the ground surface or damage to nearby facilities; and 3) prevent damage to the carrier pipe and any lining materials within the carrier pipe.

2. Installation Methods:

    a. Auger Boring: A method that utilizes a rotating cutting head to form the bore hole and a series of rotating augers inside a casing pipe to remove the spoil.
    b. Directional Drilling: A method for installing pipe from a surface-launched drilling rig. A pilot bore is formed and then enlarged by back reaming and removing the spoil material. The pipe is then pulled in place.
    c. Open-ended Pipe Ramming: A method that involves driving a steel casing pipe with a percussive hammer. The front end of the casing pipe is open-ended. Spoils are removed from the pipe.
    d. Pipe Jacking: A method in which pipe is pushed into the ground with hydraulic jacks while soil is simultaneously excavated. Excavation is normally completed with a tunnel boring machine.
    e. Microtunneling: A method of pipe jacking using a remote controlled tunnel boring machine.
    f. Utility Tunneling: A method of forming large diameter tunnels. As excavation takes place at the front of the tunnel, a liner is constructed to temporarily support the tunnel. Upon completion of the tunnel, the pipe is pushed in place.
    g. Other: Other methods may be allowed with the Engineer's approval.

3. Line and Grade:

a. Install pipe at line and grade that will allow the carrier pipe to be installed at its true starting elevation and grade within the specified maximum alignment deviation of the pipe centerline.
b. When no deviation tolerances are specified in the contract documents, apply the following maximum deviations to the carrier pipe.

1) Gravity Pipe:

a) 1.0 foot per 100 feet;
b) 0.2 feet up to 100 feet an additional +/- 0.1 foot per 100 feet thereafter. Backfall in pipe is not allowed.

2) Pressurized Pipe:

a) Horizontally: ± 2.0 feet
b) Vertically: ± 1.0 foot. Maintain the minimum depth specified in the contract documents.

c. Greater deviation or interference with other identified facilities may be cause for rejection.

4. Deviation from Line and Grade:

a. Provided adequate clearance remains for proper installation of the carrier pipe, the Contractor will be allowed to correct deviations in grade of a casing pipe in order to achieve design grade of the carrier pipe by:

1) Pouring an invert in the casing pipe
2) Shimming the carrier pipe with casing spacers to a uniform grade.
3) Installations deviating from the specified tolerances that cannot be adjusted to conform to the specified tolerances may be rejected by the Engineer. If nonconforming installation is not rejected, provide all additional fittings, manholes, or appurtenances needed to accommodate horizontal or vertical misalignment, at no additional cost to the Jurisdiction.
4) Abandon rejected installation and place special fill materials, at no additional cost to the Jurisdiction. Replace abandoned installations, including all additional fittings, manholes, or appurtenances required to replace rejected installations.

5. Un-cased Carrier Pipe Installation:

a. Install pipe by approved methods.
b. Use a jacking collar, timbers, and other means as necessary to protect the driven end of the pipe from damage.
c. Do not exceed the compressive or tensile strength capacity of the pipe during pushing or pulling operations.
d. Fully support bore hole at all times to prevent collapse. Insert pipe as soil is removed, or support bore with drilling fluid.
e. Fill space between the inside of the bore hole and the outside of the pipe with special fill material if the space is greater than 1 inch.

6. Pit Restoration

a. Remove installation equipment and unused materials from the launching and receiving pits.

b. When the carrier pipe extends beyond the limits of trenchless installation and into the bore pit, place bedding and backfill material according to Section 312333
c. Place suitable backfill material in the pit. Apply the testing requirements of Section 312333.
d. Restore the site to original condition or better.

I. Cleaning Inspection and Testing:

1. The following tests and inspection of sanitary sewers as specified in MO DNR Specifications shall be performed:
2. Exfiltration of air under pressure:

a. After the construction of the sewer mains, manholes and laterals, onto the sanitary system, the municipality shall perform a low pressure air test. Personnel will perform the air test from manhole to manhole.
b. Air leakage test results shall not be less than the time per inch of pipe diameter per length of sewer pipe as specified in ASTM F1417 – 11a (2015) Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
c. If the section of sewer fails to pass the test, it shall be the Contractor's responsibility to locate the problems and make the necessary repairs.
d. Following the successful passage of a low pressure air test, the Owner will assume responsibility for the operation and maintenance of the sewers with the exception of settlement of the sewer trenches.

3. For flexible themoplastic pipe, a deflection test with maximum 5% deflection of the average inside diameter by testing after installation by pulling 9 arm deflection mandrel, complying with applicable ASTM Standards, through sewer by hand.
4. Manholes shall be air tested for leakage by the Contractor in accordance with ASTM C1244-93, Standard Test Method for Concrete Sewer Manholes by the Negative Pressure (Vacuum) Test or most recent approved.
5. Manhole preparation:

a. Plug all lift holes.
b. Temporarily plug all pipes entering the sewer manhole, taking care to securely brace the pipes and plugs to prevent them from being drawn into the sewer manhole.

6. Test procedure:

a. The test head shall be placed at the top of the manhole in accordance with the manufacturer’s recommendations.
b. A vacuum of 10 in. Hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. Hg.
c. The manhole shall pass if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds the values indicated in Table 1 of ASTM Designation C 1244 (see below).
d.

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	39	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

e. If the manhole fails the test, the Contractor shall make necessary repairs and retest the manhole. Repairs must be repeated until the manhole passes the test.

f. If manhole joint sealants are pulled out during the vacuum test, the manhole must be disassembled and the joint sealants replaced.

g. Manholes will also be subject to visual inspection with all visual leaks being repaired.

J. Sewer Pipe and Water Main Separation:

1. Horizontal and Vertical Separation of Gravity Sewers from Water Mains shall be in accordance with Missouri DNR Specification.

3.3 FIELD QUALITY CONTROL

A. The **Owner** will provide testing services of a soils engineer and/or independent laboratory for this project. Trenching and backfilling testing shall be completed in accordance with Section 312333 “Trenching and Backfilling” of these Specifications

END OF SECTION 334101

SECTION 407113- MAGNETIC FLOW METERS

PART 1 – GENERAL

1.1 SUMMARY

A. Contractor shall provide a magnetic flow meter as specified herein for the purposes of force main flow measurement.

1.2 SUBMITTALS

A. Submittals shall be submitted as per these specifications.

B. Product Data: Submit manhole covers, component construction, features, configuration, and dimensions.

PART 2 – PRODUCTS

1.3 MANUFACTURER QUALIFICATIONS

A. Flow Meter shall be manufactured by one of the following manufacturers:
   1. Siemens
   2. Toshiba
   3. Badger Meter
   4. Or Engineer Approved Equal

B. Manufacturer must have at least 5 years of experience selling DC Pulsed magnetic flowmeters to the water/wastewater industry.

C. The manufacturer shall supply a written warranty by the manufacturer from defects in materials or workmanship for a period of at least 5 years

D. Every unit regardless of size must be flow tested in a recognized flow testing facility that is traceable to the National Institute of Standards and Technology (NIST) or other recognized standards authority.

E. The manufacturer shall provide an application performance guarantee with submittals

F. The manufacture shall provide an on time shipment guarantee.

1.4 FLOW TUBE FUCTIONALITY AND OPERATION

A. The magnetic flow meter will a maintain an accuracy of ±0.5% of flow rate or better when mounted as shown on plans.

B. All detector bodies/flow tubes must be full bore design matching line size internal dimension. No reduction in the internal flow tube that would result in system pressure loss will be accepted.

C. The meter shall have a standard certified flow accuracy of 0.2% of rate or better. There may be some slight deviation with no more than an additional ±0.5% of Reading permitted

D. Each flowmeter will be flow lab calibrated in the manufacturer's flow lab. The manufacturer will flow lab calibrate all meters twice at 0%, 50% and 100% of flow for a total of 6 flow point calibrations. The dual flow calibration technique will confirm the results of the first flow test and ensure that the meter will exhibit a typical installed accuracy of ± 0.2% or better of actual flow rate.

E. The electrodes shall be 316L stainless steel

F. Flanges will be carbon steel as standard

G. The detectors neck (connection between coils and wiring plate) shall be epoxy sealed to prevent moisture or water from entering the body of the detector.

H. All meters must be NEMA 4X watertight as standard or optionally, NEMA6P and submersible to 15m in water.

1.5 CONVERTER

A. The converter display shall allow for configuration without exposing the converter internals to the surrounding atmosphere.

B. The magnetic flowmeter converter shall be microprocessor based, have "built in" diagnostics, and retain program configuration in memory for at least 10 years.

C. The meter shall work on any conductive fluid without re-calibration for different fluid types.

D. The meter shall be capable of switching between 4 different ranges and forward/reverse 2-range switching.

E. The meter shall have a full function dot-matrix analog/digital LCD display backlit for night viewing that is electrically 360 degrees rotatable using the meter's software.

F. The meter shall incorporate high input impedance circuitry and have an input impedance of 50 meg ohm or greater thus negating the need for external electrode cleaning devices and to eliminate errors caused by changing process conductivity.

G. The converter will be supplied with surge protection in the power supply and the signal output circuit

1.6 ALARM CAPABILITY

A. The meter shall have: High, low, empty pipe, rate-of-change, limit alarms, control limit time, self diagnostics and data checking, over-range flow, under-range flow, over totalize, under totalize, range change, preset output, adjustable low flow cutoff, totalizer preset value reached, reverse flow, and converter failure alarms as standard.

1.7 OUTPUTS

A. One 4-20mA analog with HART

B. HART (standard) or Modbus RTU +4 ~20mA or PROFIBUS-PA (optional – selected one)

C. Capable of two digital outputs (for alarms, batching, and pulse applications)

1.8 INPUTS

A. One digital input (20 – 30 Volts dc) for range switching, totalizer control, fixed value outputs, zero adjustment.

1.9 ENVIRONMENTAL SPECIFICATIONS

A. The unit will have an ambient temperature rating of at least -40ºC to 60ºC (-40ºF to 140ºF).

END OF SECTION 407113