

PROJECT MANUAL

*Splash Pad & Associated Infrastructure Improvements
Bennett Spring State Park
Lebanon, Missouri*

Designed By: Landworks Studio
102 S. Cherry St.
Olathe, Kansas 66061

Date Issued: March 29, 2024

Project No.: X2228-01

STATE of MISSOURI

OFFICE of ADMINISTRATION
Facilities Management, Design & Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: X2228-01

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:

SECTIONS: 024100, 312000, 312500, 321100, 321216, 321313, 321400, 321723, 331000, 333100, 334100, 334600, AND 334900

PLANS: C-101, C-102, C-103, C-104, C-105, C-501, AND C-502



Todd R. Polk, PE

State of Missouri # PE-2001018789

Exp. 12/31/2025

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SECTIONS: 107343, 321319, AND 323300

PLANS: L-101, AND Q-101



Carisa L. McMullen, PLA

State of Missouri # LA-1999137914

Exp. 12/31/2025

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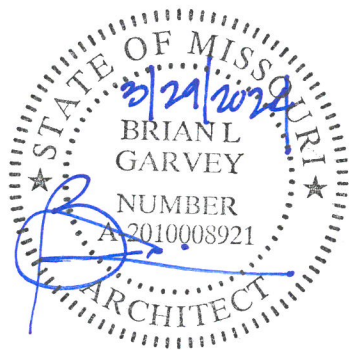
SECTIONS: ALL WITHIN DIVISIONS 03, 04, 06, 07, 08, 09, 101400, AND 102800

PLANS: A-001, A-101, A-201, AND A-301

Brian L. Garvey, RA

State of Missouri # A-201008921

Exp. 12/31/2024



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SECTIONS: 017000, 101446, ALL WITHIN DIVISION 13, 312316, 312323, 334610, AND 3344910 PLANS: Q-102, Q-103, Q-001, Q-104, Q-201, Q-501, AND Q-502

Jeff A. Bartley, PE
State of Missouri # PE-2001020800
Exp. 12/31/2025



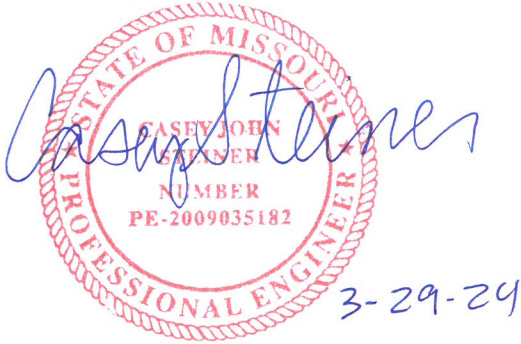
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SECTIONS: ALL WITHIN DIVISIONS 22, 23, AND 24

PLANS: M-001, M-101, P-101, P-601, E-101, E-102, E-501, AND E-601



Casey John Steiner, PE

State of Missouri # PE-2009035182

Exp. 12/31/2025

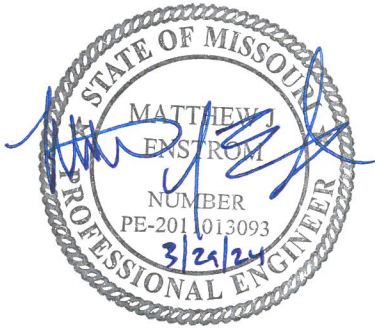
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SECTIONS: 033000, 042000, AND 061000

PLANS: S-001, S-101, AND S-501



Matthew J. Enstrom, PE

State of Missouri # PE-2011013093

Exp. 12/31/2025

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****The following documents may be found on MissouriBUYS at <https://missouribuys.mo.gov/>****

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END OF SECTION 000110

SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

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

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>	<u>CAD #</u>
1.	Cover Sheet	Sheet G-000	03/29/24	X2228-01-G-000.dwg
2.	Site Plan & Alternates Plan	Sheet G-001	03/29/24	X2228-01-G-001.dwg
3.	Demolition Plan & Alternate No. 3 Demolition Plan	Sheet C-101	03/29/24	X2228-01-C-101.dwg
4.	Site Plan & Alternates Layout	Sheet C-102	03/29/24	X2228-01-C-102.dwg
5.	Grading Plan & Alternates 2 & 3 Grading Plan	Sheet C-103	03/29/24	X2228-01-C-103.dwg
6.	Utility Plan	Sheet C-104	03/29/24	X2228-01-C-104.dwg
7.	Erosion Control Plan	Sheet C-105	03/29/24	X2228-01-C-105.dwg
8.	Details Sheet & Alternates Details	Sheet C-501	03/29/24	X2228-01-C-501.dwg
9.	Site Details	Sheet C-502	03/29/24	X2228-01-C-502.dwg
10.	Seeding Plan	Sheet L-101	03/29/24	X2228-01-L-101.dwg
11.	Playground Plan Alternate No. 2	Sheet Q-101	03/29/24	X2228-01-Q-101.dwg
12.	Spray Ground Plan	Sheet Q-102	03/29/24	X2228-01-Q-102.dwg
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Mechanical Plan				
14.	Filter Area Key Notes and Data	Sheet Q-001	03/29/24	X2228-01-Q-001.dwg
15.	Filter Area Plan	Sheet Q-104	03/29/24	X2228-01-Q-104.dwg
16.	Filter Area Section	Sheet Q-201	03/29/24	X2228-01-Q-201.dwg
17.	Spray Ground Mechanical Details	Sheet Q-501	03/29/24	X2228-01-Q-501.dwg
18.	Filter Area Details	Sheet Q-502	03/29/24	X2228-01-Q-502.dwg
19.	Typical Clearances and Mounting Heights	Sheet A-001	03/29/24	X2228-01-A-001.dwg
20.	Restroom Floor Plan and Interior Elevations	Sheet A-101	03/29/24	X2228-01-A-101.dwg
21.	Restroom Elevations and Building Sections	Sheet A-201	03/29/24	X2228-01-A-201.dwg
22.	Restroom Sections and Details	Sheet A-301	03/29/24	X2228-01-A-301.dwg
23.	Structural General Notes	Sheet S-001	03/29/24	X2228-01-S-001.dwg
24.	Restroom Plans	Sheet S-101	03/29/24	X2228-01-S-101.dwg
25.	Structural Details	Sheet S-501	03/29/24	X2228-01-S-501.dwg
26.	MPE Symbols Legend	Sheet M-001	03/29/24	X2228-01-M-001.dwg
27.	Mechanical Plan	Sheet M-101	03/29/24	X2228-01-M-101.dwg
28.	Plumbing Plan	Sheet P-101	03/29/24	X2228-01-P-101.dwg
29.	Plumbing Schedules	Sheet P-601	03/29/24	X2228-01-P-601.dwg
30.	Electrical Site Plan	Sheet E-101	03/29/24	X2228-01-E-101.dwg
31.	Lighting & Power Plan	Sheet E-102	03/29/24	X2228-01-E-102.dwg
32.	Electrical Details	Sheet E-501	03/29/24	X2228-01-E-501.dwg
33.	Electrical Schedules	Sheet E-601	03/29/24	X2228-01-E-601.dwg

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. Splash Pad & Associated Infrastructure Improvements
Bennett Spring State Park
Lebanon, Missouri
Project No.: X2228-01

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, June 6, 2024
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

4.0 DESCRIPTION:

- A. Scope: The project includes construction of a new splash pad, aquatic spray ground mechanical equipment, chemical treatment equipment, piping and features; concrete block construction, cement fiber board, asphalt shingles, bathroom accessories, site electrical, sanitary sewer, domestic water utilities; concrete paving and seeding.
- B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**
- C. ****NOTE:** Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:

- A. Place/Time: 10:00 AM, May 20, 2024, at Bennett Spring State Park, Nature Center, 26250 MO-64, Lebanon, Missouri 65536 (37.722017, -92.854950).
- 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: Landworks Studio, Brian Sturm, PLA, 913-780-6707, email: Brian@landworksstudio.com
- B. Project Manager: Scott Zeller, 573-751-2668, email: Scott.Zeller@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.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

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

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

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

2.0 - BID DOCUMENTS

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

3.0 - BIDDERS' OBLIGATIONS

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

4.0 - INTERPRETATIONS

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

5.0 - BIDS AND BIDDING PROCEDURE

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

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

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

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

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

6.0 - SIGNING OF BIDS

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

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

7.0 - RECEIVING BID SUBMITTALS

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

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

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

9.0 - AWARD OF CONTRACT

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

- C. The Owner shall award a contract to the lowest, responsive, 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 bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding an E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

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

11.0 - LIST OF SUBCONTRACTORS

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

12.0 - WORKING DAYS

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

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

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

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

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

15.0 - MBE/WBE/SDVE INSTRUCTIONS

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

B. MBE/WBE/SDVE General Requirements:

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

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

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

D. Certification of MBE/WBE/SDVE Subcontractors:

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

E. Waiver of MBE/WBE/SDVE Participation:

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

F. Contractor MBE/WBE/SDVE Obligations

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

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

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

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

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

<https://o eo .mo .gov /sdve -certification -program />

<https://veterans.certify.sba.gov/#search>



State of Missouri Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

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

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: **Splash Pad & Associated Infrastructure Improvements
Bennett Spring State Park
Lebanon, Missouri**

Project Number: **X2228-01**

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

ARTICLE 2. TIME OF COMPLETION

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

ARTICLE 3. LIQUIDATED DAMAGES

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

ARTICLE 4. CONTRACT SUM

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

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

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.

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

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

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

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

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

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

ARTICLE 7. CONTRACT DOCUMENTS

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

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
 - a. Invitation for Bid (Section 001116)
 - b. Instructions to Bidders (Section 002113)
 - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
 - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:

- i. Bid Form (Section 004113)
- ii. Unit Prices (Section 004322)
- iii. Proposed Contractors Form (Section 004336)
- iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
- v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
- vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
- vii. Missouri Service Disabled Veteran Business Form (Section 004340)
- viii. Affidavit of Work Authorization (Section 004541)
- ix. Affidavit for Affirmative Action (Section 005414)
- e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
- f. General Conditions (Section 007213)
- g. Supplementary Conditions (Section 007300)
- h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
- i. Wage Rate(s) (Section 007346)
- 2. Division 1 – General Requirements
- 3. All Drawings identified in the Project Manual
- 4. All Technical Specifications included in the Project Manual
- 5. Addenda, if applicable

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.

Further, if the Contractor provides any “personal information” as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

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



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

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

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

NAME

a sole proprietorship partnership
 limited liability company (LLC)

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

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

PROJECT TITLE

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

PRINT NAME & SIGNATURE

DATE

--

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL	STATE OF	COUNTY (OR CITY OF ST. LOUIS)	USE RUBBER STAMP IN CLEAR AREA BELOW
	SUBSCRIBED AND SWORN BEFORE ME, THIS		
	DAY OF	YEAR	
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
NOTARY PUBLIC NAME (TYPED OR PRINTED)			

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	DATE INSTALLED
LOCATION		

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



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

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) CONSULTANT CONSTRUCTION

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

PROJECT TITLE

PROJECT LOCATION

FIRM

ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment)
 \$

TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment)
 \$

THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$

SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

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
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES
NOTARY PUBLIC NAME (TYPED OR PRINTED)		USE RUBBER STAMP IN CLEAR AREA BELOW

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

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

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
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- 3.5. Operation and Maintenance Manuals
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5. Construction and Completion

- 5.1. Construction Commencement
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6. Bond and Insurance

- 6.1. Bond
- 6.2. Insurance

7. Termination or Suspension of Contract

- 7.1. For Site Conditions
- 7.2. For Cause
- 7.3. For Convenience

SECTION 007213 - GENERAL CONDITIONS

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

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

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

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

8. **"INCIDENTAL JOB BURDENS"**: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri, 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, tool, 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, and in the best manner known to each respective trade.
15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

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

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

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.
- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall

forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

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

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

B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action

in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

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

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

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

ARTICLE 1.5 - ANTI-KICKBACK

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

insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

- A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be

required for a Missouri bidder to successfully bid in the non-domiciliary state.

- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

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

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any

work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.
- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

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

ARTICLE 1.11 - INDEMNIFICATION

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

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

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

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

- A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.
- B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.
- C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice.

The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

- D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.
- F. The Owner shall have the right to direct the Contractor to uncover any completed work.
 - 1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.
 - 2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.
- G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.
- H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

- I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

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

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

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

ARTICLE 3.2 -- SUBMITTALS

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

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

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

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

possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

- F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

- A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

- A. General Guaranty
 - 1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
 - 2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
 - 3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the

damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.

4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

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

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name 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 insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.
- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case,

unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.
- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.
- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

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

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.
- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon

before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be 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 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 without compensation may be made when:
1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
 2. Labor strikes or acts of God occur, OR
 3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.
- C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.
- D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by

the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

- A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:
1. Contract;
 2. Performance/payment bond as described in Article 6.1;
 3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
 4. Written Affirmative Action Plans as required in Article 1.4.
- Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.
- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.
- C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

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

ARTICLE 5.3 -- PROJECT COMPLETION

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
 1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
 - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
 - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
 - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
 2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the

Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the

approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

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

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the

"Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

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

of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
 2. Materials stored in one location off site are valued in excess of \$25,000.
 3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
 4. The materials are stored in a facility approved and inspected, by the Construction Representative.
 5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
 2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
 4. Failure of the Contractor to update the construction schedule.
- When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.
- H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.
1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
 2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
 - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

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

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

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

ARTICLE 6.2 – INSURANCE

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

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

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

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".
 3. Workers' Compensation and Employer's Liability

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

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

to Contractor and Owner as their respective interests may appear.

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

C. Minimum Limits of Insurance

1. General Liability

Contractor

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

\$2,000,000 annual aggregate

2. Automobile Liability

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

3. Workers' Compensation and Employers Liability

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

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

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions,

as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

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

1. General Liability

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

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

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

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

2. Automobile Insurance

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

performance of services or the delivery of goods called for by the Contract.

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

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

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

3. Workers' Compensation/Employer's Liability

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

4. All Coverages

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

F. Insurer Qualifications and Acceptability

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

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its

behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

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

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

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

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.
- B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
- C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
- D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
- E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
- F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date

of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

- A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.
- B. Upon receipt of notification, the Contractor shall:
 1. Cease operations when directed.
 2. Take actions to protect the work and any stored materials.
 3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
 4. Terminate all existing subcontracts, rentals, material, and equipment orders.
 5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.
 6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.
- C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

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

2.0 CONTACTS:

Designer: Brian Sturm, PLA
Landworks Studio
102 S. Cherry St.
Olathe, Kansas 66061
Telephone: 913-780-6707
Email: Brian@landworksstudio.com

Construction Representative: John Gentges
Division of Facilities Management, Design and Construction
301 W High Street, Room 730
Jefferson City, MO 65101
Telephone: 573-526-5768
Email: John.Gentges@oa.mo.gov

Project Manager: Scott Zeller
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-751-2668
Email: Scott.Zeller@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 5 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 5 sets of explanatory or change drawings at no charge.
- C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

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

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 053
LACLEDE COUNTY

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

Original Signed by _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$25.69*
Boilermaker	\$25.69*
Bricklayer-Stone Mason	\$54.68
Carpenter	\$48.81
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$40.32
Plasterer	
Communication Technician	\$25.69*
Electrician (Inside Wireman)	\$52.71
Electrician Outside Lineman	\$25.69*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$25.69*
Glazier	\$42.50
Ironworker	\$67.95
Laborer	\$39.22
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$25.69*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$25.69*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$25.69*
Plumber	\$52.32
Pipe Fitter	
Roofer	\$25.69*
Sheet Metal Worker	\$53.53
Sprinkler Fitter	\$25.69*
Truck Driver	\$25.69*
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
LACLEDE County

Section 053

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$25.69*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$25.69*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$46.64
General Laborer	
Skilled Laborer	
Operating Engineer	\$25.69*
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$25.69*
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 construction of a new splash pad, restroom and mechanical building, accessible parking stalls, and associated concrete sidewalk and utilities.
 - 1. Project Location: Bennett Spring State Park, 26250 Highway 64A, Lebanon, Missouri 65536.
 - 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 March 29, 2024 were prepared for the Project by Landworks Studio, 120 South Cherry Street, Olathe, Kansas 66061; Phone: 913-780-6707; Email brian@landworksstudio.com.
- C. The Work consists of construction of a new splash pad, restroom and mechanical building, accessible parking stalls, and associated concrete sidewalk and utilities.
 - 1. The Work includes aquatic spray ground mechanical equipment, chemical treatment equipment, piping and features; concrete block construction, cement fiber board, asphalt shingles, and bathroom accessories, site electrical, sanitary sewer, and domestic water utilities; concrete paving, and seeding
- D. The Work will be constructed under a single prime contract.

1.3 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. 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.

1.4 OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the site prior to Substantial Completion, provided

such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Upon final completion, the Owner will assume responsibility for maintenance of the site.

1.5 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE

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.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Weather allowances.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
 - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

- A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).
- B. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

- A. Weather Allowance: Included within the completion period for this Project is FIFTEEN (15) "bad weather" days.

END OF SECTION 012100

SECTION 012200 – UNIT PRICES

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.
- B. Quantities of Units to be included in the Base Bid are indicated in Section 004322 – Unit Prices.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Unit Prices.
- B. Related Sections include the following:
 - 1. Division 1 Section "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
 - 2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Division 31 Section 312000 "Earth Moving" procedures for measurement and payment for Unclassified Excavation.
 - 4. Division 31 Section 312000 "Earth Moving" procedures for measurement and payment for Compacted Earthwork.
 - 5. Division 33 Section 331000 "Water Utility Distribution" procedures for measurement and payment for 2-inch Schedule 80 PVC Waterline.
 - 6. Division 33 Section 333100 "Sewer Utility Sewerage Piping" procedures for measurement and payment for 6-inch SDR 21 PVC Sewer Service.
 - 7. Division 33 Section 334100 "Storm Utility Drainage Piping" procedures for measurement and payment for 4-inch PVC Storm Drain.
 - 8. Division 33 Section 334600 "Subdrainage" procedures for measurement and payment 4-inch Schedule 40 Perforated PVC Under Drain.

1.3 DEFINITIONS

- A. Unit Price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit Prices include all necessary material plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those Sections.

- C. Owner reserves the right to reject Contractor's measurement of Work in-place that involves use of established Unit Prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A list of Unit Prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each Unit Price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

- A. Unit Price No. 1 – Unclassified Excavation:
 - 1. Description: General excavation for foundations, walks, pavements, and utility trenches according to Division 31 Section 312000 "Earth Moving."
 - 2. Unit of Measurement: Per Cubic Yard Excavated.
 - 3. Base Bid Quantity: 97 Cubic Yards
- B. Unit Price No. 2 – Compacted Earthwork:
 - 1. Description: Compaction of backfill soils and fills according to Division 31 Section 312000 "Earth Moving."
 - 2. Unit of Measurement: Per Cubic Yard Filled.
 - 3. Base Bid Quantity: 840 Cubic Yards
- C. Unit Price No. 3 – 2-inch Schedule 80 PVC Waterline:
 - 1. Description: Installation of pipe according to Division 33 Section 331000 "Water Utility Distribution."
 - 2. Unit of Measurement: Per Linear Foot Installed.
 - 3. Base Bid Quantity: 91 Linear Feet
- D. Unit Price No. 4 – 6-inch SDR 21 PVC Sewer Service:
 - 1. Description: Installation of pipe according to Division 33 Section 333100 "Sewer Utility Sewerage Piping."
 - 2. Unit of Measurement: Per Linear Foot Installed.
 - 3. Base Bid Quantity: 270 Linear Feet
- E. Unit Price No. 5 – 4-inch Schedule 40 PVC Storm Drain:
 - 1. Description: Installation of pipe according to Division 33 Section 334100 "Storm Utility Drainage Piping."
 - 2. Unit of Measurement: Per Linear Foot Installed.
 - 3. Base Bid Quantity: 172 Linear Feet
- F. Unit Price No. 6 – 4-inch Perforated PVC Under Drain:

1. Description: Installation of pipe according to Division 33 Section 334600 "Subdrainage."
2. Unit of Measurement: Per Linear Foot Installed.
3. Base Bid Quantity: 56 Linear Feet

END OF SECTION 012200

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.

1.4 PROCEDURES

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Provide UV treatment equipment for the spray ground as indicated by plans and details on the Drawings Q-001, Q-104, Q-201, and E-102 labelled "Alternate No. 1." Section 131185 "Equipment for Spray Grounds" includes complete product and execution requirements for the UV treatment equipment.
- B. Alternate No. 2: Provide and install a playground including play equipment, rubberized surfacing, subdrainage, and associated concrete sidewalk as indicated by plans and details on

the Drawings G-001, C-102, C-104, and Q-101 labelled “Alternate No. 2.” Section 116800 “Playground Equipment and Structures” and Section 321816 “Rubberized Surfacing” include complete product and execution requirements for the equipment and rubberized safety surfacing.

- C. Alternate No. 3: Conduct a mill and overlay of a portion of the existing asphalt parking lot as indicated by plans and details on the Drawings G-001, C-101, C-102, and C-501 labelled “Alternate No. 3.” Section 321216 “Asphalt Paving” includes complete product and execution requirements for the asphalt mill and overlay.

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 012200 "Unit Prices" for administrative requirements for using Unit Prices.
 - 3. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
 - 4. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
 - 5. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

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

notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

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

1.5 PROPOSAL REQUESTS

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

1.6 CHANGE ORDER PROCEDURES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which depend on each other for proper installation, connection, and operation.
- B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required

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

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

- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Startup and adjustment of systems.
 - 8. Project Closeout activities.

- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

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

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

1. Minutes: Designer will record and distribute meeting minutes.
- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".
1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Review of mockups
 - i. Possible conflicts
 - j. Compatibility problems
 - k. Time schedules
 - l. Weather limitations
 - m. Manufacturer's written recommendations
 - n. Warranty requirements
 - o. Compatibility of materials
 - p. Acceptability of substrates
 - q. Temporary facilities and controls
 - r. Space and access limitations
 - s. Regulations of authorities having jurisdiction
 - t. Testing and inspecting requirements

- u. Installation procedures
 - v. Coordination with other Work
 - w. Required performance results
 - x. Protection of adjacent Work
 - y. Protection of construction and personnel
3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
 6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
 7. Project name
 8. Name and address of Contractor
 9. Name and address of Designer
 10. RFI number including RFIs that were dropped and not submitted
 11. RFI description
 12. Date the RFI was submitted
 13. Date Designer's response was received
 14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013115 - PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

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

- l. Specifications.
 - m. Request for Proposals
 - n. Designer's Supplemental Instructions
 - o. Punch Lists
- H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
- a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors 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 Subcontractors 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 received in paper document form.
 - c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.
- I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
- 1. Providing suitable computer systems for each licensed user at the users normal work location¹ with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 - 2. Each of the above referenced computer systems shall have the following minimum system² and software requirements:
 - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
 - 1) Operating System: Windows XP or newer
 - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
 - 3) Minimum Recommend Connection Speed: 256K or above.
 - 4) Processor Speed: 1 Gigahertz and above
 - 5) RAM: 512 mb
 - 6) The 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 can still 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.

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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

SECTION 013200 – SCHEDULES – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

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

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

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor’s Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of “bad” weather days specified in Section 012100 – Allowances.
 - 1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
 - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
 - 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar shall 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. 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

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 the 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 a 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 fully comply with submittal requirements. 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 Drawings	Shop Drawings
013100	Key Personnel Names	Shop Drawings
013200	Progress Schedule	Construction Schedule
013200	Schedule of Values	Schedule of Values
013200	Schedule of Submittals	Shop Drawings
015000	Temporary Utilities	Test Report
015000	Temporary Utilities	Construction Schedule
017000	General Requirements for Spray Grounds	Test Report
017900	Instruction Programs	Operation / Maintenance Manual
017900	Attendance Records	Shop Drawings
017900	Evaluations	Shop Drawings
017900	Demo and Training Video Recordings	Operation / Maintenance Manual
017900	Transcript	Shop Drawings
033000	Cast-in-Place Concrete	Product Data
033000	Design Mixtures	Shop Drawings
033000	Steel Reinforcement	Shop Drawings
033000	Formwork	Shop Drawings
033000	Construction Joint Layout	Shop Drawings
033000	Aggregate	Test Report
033000	Cast-in-Place Concrete	Mock up
033511	Concrete Floor Finishes	Product Data
040511	Masonry Mortar Mix	Shop Drawings
040511	Masonry Mortar Mix	Sample
040511	Masonry Mortar Manufacturer	Certification
042000	Unit Masonry	Product Data
042000	Unit Masonry	Shop Drawings
042000	Unit Masonry	Mock up
042000	Unit Masonry	Test Report
061000	Rough Carpentry	Product Data
072500	Weather Barriers	Product Data
072500	Weather Barriers	Shop Drawings
073113	Asphalt Shingles	Product Data
073113	Metal Flashing	Shop Drawings
073113	Asphalt Shingles	Sample
073113	Asphalt Shingles	Warranty
074646	Fiber-Cement Siding	Product Data
074646	Fiber-Cement Siding	Certification
074646	Fiber-Cement Siding	Operation / Maintenance Manual
074646	Fiber-Cement Siding	Warranty
076200	Sheet Metal Flashing and Trim	Shop Drawings
077200	Roof Accessories	Product Data
079200	Joint Sealants	Product Data
081113	Hollow Metal Doors and Frames	Product Data
081113	Hollow Metal Doors and Frames	Shop Drawings
087100	Door Hardware	Product Data

087100	Door Hardware	Shop Drawings
087100	Door Hardware Lock Cylinders and Tools	Operation / Maintenance Manual
087100	Door Hardware	Warranty
099113	Exterior Painting	Product Data
099113	Exterior Painting	Sample
099113	Exterior Painting	Operation / Maintenance Manual
099123	Interior Painting	Product Data
099123	Interior Painting	Sample
099123	Interior Painting	Certification
099123	Interior Painting	Operation / Maintenance Manual
099600	High Performance Coatings	Product Data
099600	High Performance Coatings	Sample
099600	High Performance Coatings	Certification
099600	High Performance Coatings	Operation / Maintenance Manual
101400	Signage	Product Data
101400	Signage	Sample
101400	Signage	Operation / Maintenance Manual
101446	Chemical Signs for Spray Grounds	Product Data
102800	Toilet, Bath, and Laundry Accessories	Product Data
102800	Toilet, Bath, and Laundry Accessories	Operation / Maintenance Manual
116800	Playground Equipment	Product Data
116800	Playground Equipment	Shop Drawings
131414	Waterstop for Spray Grounds	Sample
131115	Formwork and Reinforcing	Product Data
131115	Concrete Materials Testing	Test Report
131115	Concrete Mix Design	Shop Drawings
131185	Equipment for Spray Grounds	Product Data
131185	Equipment for Spray Grounds	Shop Drawings
131185	Equipment for Spray Grounds	Operation / Maintenance Manual
131185	Equipment for Spray Grounds	Warranty
131187	Chemical Controller for Spray Grounds	Product Data
131187	Chemical Controller for Spray Grounds	Shop Drawings
131187	Chemical Controller for Spray Grounds	Operation / Maintenance Manual
131187	Chemical Controller for Spray Grounds	Warranty
131190	Piping and Valves for Spray Grounds	Product Data
131192	Plumbing Specialties for Spray Grounds	Product Data
131194	Mechanical Identification for Spray Grounds	Shop Drawings
131420	Water Spray Features for Spray Grounds	Product Data
131420	Water Spray Features for Spray Grounds	Shop Drawings
131420	Water Spray Features for Spray Grounds	Certification
131420	Water Spray Features for Spray Grounds	Operation / Maintenance Manual
131420	Water Spray Features for Spray Grounds	Warranty
220100	General Plumbing Requirements	As-Builts
220100	General Plumbing Requirements	Operation / Maintenance Manual
220519	Meters and Guages	Product Data
220523	Piping Specialties and Valves	Product Data
220529	Piping Supports, Anchors, and Seals	Product Data

220550	Domestic Water Piping Interior Lines Test	Test Report
220553	Plumbing Identification	Product Data
220553	Plumbing Identification	Shop Drawings
220716	Plumbing Insulation	Product Data
221100	Domestic Water Pipe and Fittings	Product Data
221110	Domestic Water Pex Piping	Product Data
221119	Reduced Pressure Backflow Preventor	Product Data
221300	Sanitary Pipe and Fittings	Product Data
221319	Cleanours and Floor Drains	Product Data
223300	Electric Water Heaters	Product Data
224200	Plumbing Fixtures and Trim	Product Data
230100	General HVAC Requirements	As-Builts
230100	General HVAC Requirements	Operation / Maintenance Manual
230553	HVAC Identification	Product Data
233713	Grilles, Registers, Diffusers, and Louvers	Product Data
260100	General Electrical Requirements	As-Builts
260100	General Electrical Requirements	Operation / Maintenance Manual
260526	Grounding and Bonding	Product Data
260527	Equipotential Bonding System	Product Data
260527	Equipotential Bonding System Test	Test Report
260533	Above Ground Raceways and Boxes	Product Data
260543	Underground Raceways and Boxes	Product Data
260553	Panel Schedule	Product Data
260939	Lighting Control Devices	Product Data
262416	Panelboards	Product Data
262913	Motor Starters and Controllers	Product Data
262923	Variable Speed Controllers	Product Data
264313	Surge Protective Devices	Product Data
265113	Interior Lighting	Product Data
265613	Exterior Lighting	Product Data
312000	Geotextile	Product Data
312000	Geotechnical Testing Agency	Certification
312000	Soil Subgrade, Fills, and Backfills	Test Report
312323	Fill and Backfill for Spray Grounds	Sample
312323	Fill and Backfill for Spray Grounds	Test Report
312500	Erosion and Sediment Control	Construction Schedule
321100	Cast-in-Place Concrete	Product Data
321100	Concrete Design Mixtures	Shop Drawings
321100	Steel Reinforcement	Shop Drawings
321100	Joint Layout	Shop Drawings
321100	Concrete Testing Agency	Certification
321100	Cast-in-Place Concrete	Test Report
321216	Asphalt Paving Mix Design	Shop Drawings
321313	Concrete Paving	Product Data
321313	Concrete Paving Mix Designs	Shop Drawings
321313	Concrete Paving	Test Report
321373	Concrete Paving Joint Sealants	Product Data

321723	Pavement Markings	Product Data
321723	Pavement Markings	Shop Drawings
321816	Rubberized Surfacing	Product Data
321816	Rubberized Surfacing	Sample
321816	Rubberized Surfacing	Warranty
331000	Water Utility Distribution	Test Report
331000	Water Utility Distribution	Product Data
333100	Sanitary Utility Sewerage Piping	Product Data
333100	Sanitary Utility Field Test Report	Test Report
334100	Storm Utility Field Quality Control	Test Report
334600	Subdrainage	Product Data
334910	Wet Pit for Spray Grounds	Product Data
334910	Wet Pit for Spray Grounds	Shop Drawings

END OF SECTION 013300

SECTION 013513.31 - 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. 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.
- E. Storing materials or parking under tree canopies is not allowed.

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 from any material or equipment used during construction. The Contractor shall keep volatile waste 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. 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.
- G. 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 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.

3.4 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall always conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created

during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.

2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:
 - a. clients, staff, the public, construction personnel, and other persons who may be affected thereby.
 - b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
 - c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement during construction.
2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property

referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.

6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing, and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
9. The Contractor shall promptly notify in writing the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site, or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment to either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 013513.31

SECTION 014000 – QUALITY REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Quality control.
- B. Tolerances.
- C. References.
- D. Labeling.
- E. Testing and inspection services.
- F. Manufacturers' field services.
- G. Testing by Engineer.

1.2 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- C. Perform Work using persons qualified to produce required and specified quality.
- D. Products, materials, and equipment may be subject to inspection by Engineer and Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.
- E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.

- B. Conform to reference standard by date of issue current as of date of Contract Documents except where specific date is established by code.
- C. Obtain copies of standards and maintain on Site when required by product Specification Sections.
- D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.5 LABELING

- A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.
- C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.6 TESTING AND INSPECTION SERVICES

- A. Owner will provide Engineer for the following tests and inspections:
 - 1. Cast-in-Place concrete (033000)
 - 2. Unit masonry (042000)
 - 3. Spray ground concrete materials (131115)
 - 4. Domestic water piping interior lines (220550)
 - 5. Equipotential bonding system (260527)
 - 6. Soil subgrades, fill, and backfill (312000)
 - 7. Fill and backfill for spray grounds (312323)
 - 8. Cast-in-place concrete for sitework (321100)
 - 9. Concrete paving (321313)
- B. Contractor/supplier shall be responsible for all shop inspections and certifications including:
 - 1. Playground equipment (116800)
 - 2. Water spray features (131420)

1.7 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment as applicable, and to initiate instructions when necessary.

- B. Submit qualifications of observer to Engineer 30 days in advance of required

observations. Observer is subject to approval of Engineer.

- C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.
- D. Refer to Section 013300 - Submittals.

1.8 MATERIAL TESTS

- A. Includes all materials tests or tests specified hereinafter.
- B. Employ approved testing laboratory to show that construction materials comply with specifications.
- C. Contractor shall provide samples of materials required for laboratory tests and pay costs of all tests including transportation charges on samples.
- D. Incorporate no materials in work until laboratory tests have been furnished which show materials comply with specifications.
- E. All materials shall be subject to sampling, testing, inspection, and rejection at site by Engineer.
- F. Laboratory tests for materials:
 - 1. Spray ground concrete materials
 - 2. Fill and backfill for spray grounds
 - 3. Structural Steel: Certified copies of mill tests; ASTM A36.
 - 4. Cement: Bin sample for entire replacement, ASTM C150.
 - 5. Concrete Aggregates: One sample of each, ASTM C33.
 - 5. Two concrete compression cylinders from trial batch for each proposed mix, ASTM C39; test one at 7 days, one at 28 days; test random cylinders during construction.
 - 6. Reinforcing Steel: Certify that reinforcing steel conforms to ASTM A615 for grade specified.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION

3.1 SCHEDULE OF TESTING

- A. Coordinate with Engineer to allow the performance of tests, inspections, and other services specified in individual Specification Sections, as required by Engineer, and as shown in the following Schedule:
 - 1. Provide Standard Proctor in accordance with ANSI/ASTM D698 for each type of material requiring density tests.
 - 2. In-place density tests according to requirements of Section 312323 Fill.
 - 3. Section 033000 – Cast-In-Place Concrete according to the requirements of Field Quality Control.

END OF SECTION 014000

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. Temporary electric power and light
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds
 - 2. Dewatering facilities and drains
 - 3. Temporary project identification signs and bulletin boards
 - 4. Waste disposal services
 - 5. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, to following:
 - 1. Barricades, warning signs, and lights
 - 2. Enclosure fence for the site
 - 3. Environmental protection

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department, and rescue squad rules
 - 5. Environmental protection regulations

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

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.
 - 1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 - 2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
 - 3. For fences and vision barriers, provide minimum 3/9” (9.5mm) thick exterior plywood.
 - 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8” (16mm) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.
- E. Paint: Comply with requirements of Division 9 Section “Painting”.
 - 1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.

2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.
- F. 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 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.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
1. Install electric power service underground, except where overhead service must be used.
 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- C. 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.
- D. 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.
- E. 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: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.
- C. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- D. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- E. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and people seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
 - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 - 2. 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. 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.
- B. Enclosure Fence: Before excavation begins, install an enclosure fence. Locate where indicated on Drawing C-101 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 4-foot-high construction fence composed of orange contractor-grade material with studded metal tee posts spaced no more than 10 feet apart as shown in Detail 18 on Drawing C-502.
- C. 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 owner.

END OF SECTION 015000

SECTION 017000 - GENERAL REQUIREMENTS FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Responsibility of cost of wet pit fill water and chemicals.
- B. Water loss testing.
- C. Demonstration and instruction of Owner personnel.
- D. Operation.
- E. Winterization requirements.

1.2 RELATED SECTIONS

- A. Division 1 - General Requirements.

PART 2 PRODUCTS

2.1 WET PIT FILL WATER AND CHEMICALS

- A. Cost of Fill Water: By Contractor.
- B. Cost of chemicals required for start-up and operation: By Contractor.

PART 3 EXECUTION

3.1 WATER LOSS TESTING

- A. After the wet pit has been filled and is operational, perform a water loss test on all water holding structures and piping systems. All testing shall be performed in company with the Owner and/or Engineer.
- B. Testing procedures shall be as follows:
 - 1. Run the recirculation system as well as all water feature systems under normal operating conditions.
 - 2. Where exposed for viewing, check all water holding structures and piping systems for visible leaks. Report any leaks along with recommended repair

procedures to the Engineer for review and approval. Upon approval, make the necessary repairs.

3. Turn off all water make-up systems.
 4. Verify the water level in the surge tank is at normal operating level. Measure and record the surge tank water level from the top of the pit down to water level.
 5. Place a five-gallon bucket, partially filled with water to offset its buoyancy, within the wet pit structure such that the rim is above water level (this could be placed on a step, placed on or supported from the wet pit bottom, or somehow supported from above).
 6. Fill the bucket with water to the exact level of the surrounding wet pit water. (The purpose of the water filled bucket is to measure losses due to evaporation. Water loss in the wet pit greater than that observed in the bucket indicates losses in excess of evaporation and so it can be concluded that leakage exists.)
 7. Mark the inside and outside of the bucket with a permanent marker at the water level.
 8. Run the recirculation system as well as all water feature systems under normal operating conditions for a 24-hour period with the bucket in place.
 9. After 24-hours, measure and record the surge tank water level from the top of the pit down to water level. Compare the results of the water level with that taken at the start of testing. Report these values to the Engineer for review. A substantial difference in these values indicate water loss.
 10. Compare the water level in the bucket with the wet pit water level. Report these values to the Engineer. If the water level in the bucket and the wet pit water level are the same and the surge tank measurements above are not substantially different, then the test passed. If the wet pit water level is below the level of the water in the bucket, the test failed and a leak is present.
 11. Repeat the above steps with the recirculation system and water feature systems turned off. Report all measurements to the Engineer. If the difference between the level of water in the bucket and the level of the wet pit water is less than that measured with the recirculation system on, then the leak is likely in the recirculation system. If the difference between the level of water in the bucket and the level of the wet pit water is the same as that measured with the recirculation system on, then the leak is most likely in the wet pit structure.
- C. If testing indicates water loss or leakage, locate the source of water loss and report the source(s) and recommended repair procedures to the Engineer for review and approval. Once the repair procedures are approved, make the necessary repairs and perform the water loss testing procedures again.

3.2 DEMONSTRATION AND INSTRUCTION

- A. Refer to spec section 017900 for all demonstration and training.
- B. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.3 OPERATION

- A. For a period of 15 days after substantial completion, operate the recirculation, filtration, and chemical feed systems.
- B. Operation shall include, but not necessarily limited to, the following:
 - 1. Operation of the recirculation systems.
 - 2. Backwashing the filters when required.
 - 3. Maintaining appropriate levels of free available chlorine in the wet pit at all times.
 - 4. Adjusting the water chemistry to maintain ideal water balance conditions. This includes monitoring and adjusting total alkalinity, calcium hardness, and pH.
 - 5. Operation of all recirculation and feature pumps including adjusting flows as required for each system.
- C. Maintain appropriate operating records.
- D. After substantial completion, routine maintenance (e.g. vacuuming, cleaning the decks, cleaning the bathhouse, etc...), will be the responsibility of the Owner.

3.4 WINTERIZATION

- A. Provide a qualified person who is knowledgeable about the Project to perform winterization and instruction of owner personnel.
- B. Winterize the facility for the first season and instruct the Owner's personnel on the winterization of all equipment and piping systems. Provide written instructions on winterizing all facilities, including wet pit and bathhouse, and provide training of staff on winterizing procedures.

END OF SPEC SECTION 017000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

- A. General
 - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
 - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. Daily, 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.

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. Leave the Project clean and ready for occupancy.
 6. The site shall be restored to condition prior to commencement of construction activities.
- 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 them 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 017900 - DEMONSTRATION AND TRAINING

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

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Attendance Record: For each training module, submit a list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of the end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

- a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 007213 "General Conditions".
- B. Set up instructional equipment at the instructional location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner with at least seven days' advance notice.

- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record the demonstration and training modules. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At the beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 024113 - SITE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

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

1.2 PROTECTION

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

- D. Adjacent Properties: Protect adjacent properties during site demolition operations. Site demolition shall be limited to Owner's property. The Contractor shall also protect existing structures on adjacent properties; including by not limited to fences, utility lines, manholes, catch basins, valve boxes, poles, guys and other appurtenances. Damage done to structures on adjacent properties shall be the Contractor's responsibility to repair, at no additional cost to the Owner.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 DEMOLITION

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

3.2 RELOCATION AND RETURN OF MATERIAL OR EQUIPMENT

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

3.3 DISPOSITION OF MATERIALS

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

3.4 BACKFILLING AND COMPACTION

- A. Backfill holes and depressions resulting from site demolition in the manner described in Section 312000 Earth Moving.

END OF SECTION 024113

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Formwork Shop Drawings: Provide formwork shop drawings, including full detailed elevations for all walls and concrete features exposed to view in the finish work. Include details of ties, joints and formliners and the like needed to complete the work.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, & testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Semirigid joint filler.
 - 11. Joint-filler strips.
 - 12. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs only Project personnel qualified as ACI-certified Flatwork Technicians and Finishers and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.
- E. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform pre-construction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301
 - 2. ACI 117

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- C. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

- D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780/A 780M.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I, or Type II, gray.
 - 2. Fly Ash: ASTM C 618, Class F or C.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Provide Class 5S for architecturally decorative concrete exposed to direct weather.
 - 2. Maximum Coarse-Aggregate Size: 1 inch for footings, pile caps and grade beams, 3/4 inch nominal for all other structural concrete.
 - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. 15-mil thickness.

2.7 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-loadbearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

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

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Slag Cement: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to the following percentages by weight of cement:
 - 1. 0.06 percent for post-tensioned concrete, o
 - 2. 0.15 percent for exterior concrete exposed to free-thaw including perimeter foundation walls,
 - 3. 1.00 percent for all other interior reinforced concrete.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated on the drawings.
 2. Maximum W/C Ratio: As indicated on the drawings.
 3. Slump Limit: 5 inches, or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- B. Foundation Walls: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated on the drawings.
 2. Maximum W/C Ratio: As indicated on the drawings.
 3. Slump Limit: 5 inches, or up to 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated on the drawings.
 2. Maximum W/C Ratio: As indicated on the drawings.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
 4. Air Content for exterior slabs: 6 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 5. Air Content: Do not allow air content of interior trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

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

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

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

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with the strict tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for not less than 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations and curing and protection operations must be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical construction joints in walls as indicated, but not more than 90-feet o.c. if not otherwise shown. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - a. Space additional vertical control joints in walls at not more than 20-feet o.c. if not otherwise shown.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 9200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

- A. Coordinate final schedule of wall finishes types and locations with Owner and Architect prior to construction.
- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- D. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform

color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated, to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated, exposed to view, or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish slab-on-grade surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values SOV of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values MLV of flatness, F(F) 17; and of levelness, F(L) 15. Use for areas with carpeted floors, for Marina and Restroom Interior Floors.
 - b. Specified overall values SOV of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values MLV of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade. Use for Landing facility interior floors and other spaces where finishes include thin-set flooring, or resilient floor coverings.

- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Polished Concrete Floors: Refer to Section 033511 "Concrete Floor Finishes"

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches to 6 inches high per m/e/p requirements unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi at 28 days. Air entrain all exterior concrete.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.

1.02 ADMINISTRATIVE REQUIREMENTS

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

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittal, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.05 FIELD CONDITIONS

- A. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Unless otherwise indicated, all concrete floors are to be finished using penetrating sealer.
- B. Penetrating Clear Sealer:
 - 1. Use at following locations: All interior slabs on grade.

2.02 COATINGS

- A. Penetrating Sealer: Transparent, non-yellowing, water-based coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.

- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

END OF SECTION 033511

SECTION 040511 - MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.
- C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2019.
- L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2016a.
- M. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

- E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, damage, and foreign matter.

1.06 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Mortar Mix Designs: ASTM C270, Property Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, Loadbearing Masonry: Type S.
 - 3. Exterior, Non-loadbearing Masonry: Type S.
 - 4. Interior, Loadbearing Masonry: Type N.
 - 5. Interior, Non-loadbearing Masonry: Type N.
- C. Grout Mix Designs:
 - 1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
 - 2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type N.
 - 2. Color: Standard gray
- B. Portland Cement: ASTM C150/C150M.
 - 1. Type: Type I - Normal; ASTM C150/C150M.
 - 2. Color: Standard gray.
- C. Masonry Cement: ASTM C91/C91M.
 - 1. Type: Type N; ASTM C91/C91M.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Quicklime: ASTM C5, non-hydraulic type.
- F. Mortar Aggregate: ASTM C144.
- G. Grout Aggregate: ASTM C404.
- H. Water: Clean and potable.
- I. Accelerating Admixture: Nonchloride type for use in cold weather.
- J. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.
- K. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

3.02 GROUTING

- A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 16 inches.
 - 2. Limit height of masonry to 16 inches above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

END OF SECTION 040511

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Concrete masonry units.
 2. Mortar and grout.
 3. Steel reinforcing bars.
 4. Masonry-joint reinforcement.
 5. Embedded flashing.
 6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 1. Weep holes/vents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 1. Masonry units.
 - a. Include data on material properties.
 2. Integral water repellent used in CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 36 inches high by full thickness.
 2. Build sample panels facing south.
 3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
 4. Protect approved sample panels from the elements with weather-resistant membrane.
 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent where indicated.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
- C. Insulated CMUs: Where indicated, units shall contain rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.
- D. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Density Classification: Lightweight or Medium weight for all interior walls, and Normal weight for all exterior walls exposed directly to weather.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:

- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
- E. Mortar Cement: ASTM C 1329/C 1329M.
- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from the same manufacturer.
- J. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in the center of cells. Units are formed from 0.148-inch

steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
 - 1. Hot-dip galvanized carbon steel.
 - 2. Wire Size for Side Rods: 9 gage, 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 9 gage, 0.148-inch diameter.
 - 4. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.

2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 3.
 - 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 1/4-inch- diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated, bent to configuration indicated.
 - 1. Corrosion Protection: Hot dip galvanized to comply with ASTM A 153/A 153M.

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.

2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees.
6. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
8. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees.
9. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
10. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
11. Solder metal items at the corners.

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

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film.
 - a. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
2. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin.
 - a. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
3. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
 - b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch-thick coating of adhesive.
 - c. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch-thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.
 - 1) Color: as indicated.
 - d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
4. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch thick.

C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral

weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

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

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.11 MASONRY-CELL FILL

- A. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use Portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2,000 psi.

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

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

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

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

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-CELL FILL

- A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.

2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
 - C. Provide continuity at wall intersections by using prefabricated T-shaped units.
 - D. Provide continuity at corners by using prefabricated L-shaped units.
 - E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 1. Provide an open space not less than 1 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood products.
 - 2. Wood-preservative-treated lumber.
 - 3. Dimension lumber framing.
 - 4. Glued-Laminated timber framing.
 - 5. Miscellaneous lumber.
 - 6. Wood Decking.
 - 7. Wood Sheathing.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.
 - 4. WCLIB: West Coast Lumber Inspection Bureau.
 - 5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering them with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 4. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
 1. Boards: 19 percent.
 2. Dimension Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1, Use categories as follows:
 1. UC1: Interior construction in contact with ground or subject to moisture. Include all rough carpentry.
 - a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - c. Wood floor plates that are installed over concrete slabs-on-grade.
 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 3. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 4. After treatment, redry boards dimension lumber to 19 percent maximum moisture content.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Load-Bearing Partitions by Grade: No. 2 grade.
 - 1. Application: Exterior walls and interior load-bearing partitions.
 - 2. Species:
 - a. Southern pine; SPIB.
 - b. Douglas fir-larch; WCLIB or WWPA.
 - c. Southern pine or mixed southern pine; SPIB.
- B. Joists, Rafters, and Other Framing by Grade: No. 2 grade.
 - 1. Species:
 - a. Southern pine; SPIB.
 - b. Douglas fir-larch; WCLIB or WWPA.
 - c. Southern pine or mixed southern pine; SPIB.

2.4 GLUED-LAMINATED TIMBER FRAMING

- A. Provide structural glue-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed work.
 - 2. Provide structural glued-laminated timber made from single species.
 - 3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 - 4. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.
- B. Species and Grades for Structural Glued-Laminated Timber: Douglas fir-larch that complies with structural properties indicated on the drawings.

- C. Appearance Grade: Architectural complying with AITC 110.

2.5 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 - 1. Southern pine; SPIB.
 - 2. Douglas fir-larch; WCLIB or WWPA.
 - 3. Southern pine or mixed southern pine; SPIB.
- C. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 WOOD ROOF DECKING

- A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.
- B. Roof Decking Species: As indicated.
- C. Roof Decking Nominal Size: As indicated.
- D. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- E. Face Surface: Smooth
- F. Edge Pattern: As indicated.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.8 WOOD SHEATHING

- A. Plywood Sheathing: Exterior, Structural I sheathing.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

2.9 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.10 METAL FRAMING ANCHORS

- A. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: As indicated.
 - 2. Thickness: As indicated.
 - 3. Length: As indicated.
- B. Rafter Tie-Downs (Hurricane or Seismic Ties): As indicated.
- C. Materials: Unless otherwise indicated, fabricate from the following materials:
 - 1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - a. Use for interior locations unless otherwise indicated.
 - 2. Stainless steel bars and shapes complying with ASTM A276/A276M.
 - a. Use for exterior locations and where indicated.

2.11 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:
 - 1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
 3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install solid-sawn wood roof decking to comply with AITC 112.
1. Locate end joints for controlled random lay-up unless other lay-up indicated on the plans.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- G. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with the function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- O. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- P. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.

3.5 INSTALLATION OF ROOF JOIST FRAMING

- A. Roof Joists: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- B. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.6 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preservative treated wood materials.
- B. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. AWWA U1 - Use Category System: User Specification for Treated Wood; 2023.
- B. PS 20 - American Softwood Lumber Standard; 2021.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. 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.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing for sizes 2 by 2 through 2 by 6:
 - 1. Grade: No.2.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No.2 or Standard Grade.
 - 2. Boards: Standard or No.3.

2.03 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. 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.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 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.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.04 CLEANING

- A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061053

SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.04 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of single wythe masonry and concrete exterior walls use air barrier sheet, self-adhered type.
 - 2. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 120 of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
- B. Air Barrier Sheet, Self-Adhered: Provide primer on substrate material.
 - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: As recommended by sheet manufacturer.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Adhered flexible flashing membrane by weather barrier manufacturer for use at openings, material transitions, and other locations recommended by manufacturer.
- C. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
 - 4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 - 5. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant.
 - 6. Install water-resistive barrier over jamb flashings.
 - 7. Install air barrier and vapor retarder underneath the jamb flashings.
 - 8. Install head flashings under weather barrier.
 - 9. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- E. Self-Adhered Sheets:
 - 1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
 - 2. Lap sheets shingle-fashion to shed water and seal laps air tight.
 - 3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
 - 4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
 - 5. At wide joints, provide extra flexible membrane allowing joint movement.
- F. Coatings:
 - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
 - 2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
 - 3. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch; use sheet seal to join to adjacent construction, seal air tight with sealant.
 - 4. Use flashing to seal to adjacent construction and to bridge joints.
- G. Openings and Penetrations in Exterior Weather Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.

3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Asphalt shingle roofing.
- B. Flexible sheet membranes for eave protection and underlayment.
- C. Metal flashing.

1.02 RELATED REQUIREMENTS

- A. Section 076200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.03 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- B. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2016a.
- C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules; 2023.
- D. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.
- E. NRCA (RM) - The NRCA Roofing Manual; 2024.

1.04 SUBMITTALS

- A. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
- B. Shop Drawings: For metal flashings, indicate specially configured metal flashings.
- C. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

- A. Provide lifetime manufacturer's warranty for coverage against black streaks caused by algae.
- B. Provide 20 -year manufacturer's warranty for all damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Asphalt Shingles:
 - 1. GAF; HDZ Series Asphalt Shingle: www.gaf.com.
 - 2. IKO Industries Inc: www.iko.com.
 - 3. Certainteed; Landmark Series; www.certainteed.com.

2.02 ASPHALT SHINGLES

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
 - 1. Fire Resistance: Class C, complying with ASTM E108.
 - 2. Wind Resistance: Class F, when tested in accordance with ASTM D3161/D3161M.
 - 3. Algae resistant.
 - 4. Color: Weathered Wood.

2.03 SHEET MATERIALS

- A. Eave Protection Membrane:
 - 1. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.
- B. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
 - 1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
- C. Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

2.04 METAL FLASHING

- A. Metal Flashing: Galvanized steel; see Section 076200.

2.05 ACCESSORIES

- A. Roofing Nails: Standard round wire shingle type, suitable for all components of the assembly and substrate, minimum 3/8 inch head diameter, 12 gage, 0.109 inch nail shank diameter, 1-1/2 inch long and complying with ASTM F1667.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

- A. Broom clean deck surfaces before installing underlayment or eave protection.

3.03 INSTALLATION

- A. Eave Protection Membrane:
 - 1. Install eave protection membrane from eave edge to minimum 48 inches up-slope beyond interior face of exterior wall.
- B. Underlayment:
 - 1. Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer and nail in place.
 - 2. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.
- C. Metal Flashing:
 - 1. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- D. Shingles:
 - 1. Install shingles in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
 - a. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
 - b. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
 - 2. Place shingles in straight coursing pattern with 5-inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
 - 3. Project first course of shingles 3/4 inch beyond fascia boards.
 - 4. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
 - 5. Complete installation to provide weathertight service.

3.04 PROTECTION

- A. Do not permit traffic over finished roof surface; protect roofing until completion of project.

END OF SECTION 073113

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber cement siding.

1.02 RELATED REQUIREMENTS

- A. Section 061053 - Miscellaneous Rough Carpentry: Siding Attachment.
- B. Section 072500 - Weather Barriers: Water-resistive barrier under siding.
- C. Section 099113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- B. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- C. Installer's qualification statement.
- D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- E. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

PART 2 PRODUCTS

2.01 SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Style: Standard lap style.
 2. Texture: Simulated cedar grain.
 3. Length: 12 ft, nominal.
 4. Width (Height): 7-1/4 inches.
 5. Thickness: 5/16 inch, nominal.
 6. Finish: Factory applied primer compatible with finish as indicated on drawings.
 7. Warranty: 20 year limited; transferable.
 8. Acceptable Manufacturers:
 - a. Allura, a division of Plycem USA, Inc; Traditional Lap: www.allurausa.com.
 - b. Basis of Design: James Hardie Building Products, Inc; HardiePlank Lap Siding: www.jameshardie.com.
 - c. Nichiha USA, Inc; NichiBoard: www.nichiha.com.
- B. Board and Batten Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Texture: Simulated cedar grain.
 2. Provide battens with matching texture spaced at 12 inches o.c.
 3. Length (Height): 96 inches, nominal.
 4. Width: 48 inches.
 5. Thickness: 5/16 inch, nominal.
 6. Finish: Factory applied primer compatible with finish as indicated on drawings.
 7. Warranty: 50 year limited; transferable.

2.02 ACCESSORIES

- A. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches, minimum.
- B. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistant barrier has been installed over substrate completely and correctly; see Section 072500.

- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Protect surrounding areas and adjacent surfaces during execution of this work.
- B. Install Sheet Metal Flashing:
 - 1. Above door and window trim and casings.
 - 2. Above horizontal trim in field of siding.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details as indicated on drawings.
 - 4. Touch up field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Masonry Walls: Install furring strips of adequate thickness to accept full length of nails and spaced at 16 inches on center; leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips.
- C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- D. Do not install siding less than 6 inches from ground surface, or closer than 2 inches to roofs, patios, porches, and other surfaces where water may collect.
- E. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- F. Finish Painting: See Section 099113.

3.04 PROTECTION

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

END OF SECTION 074646

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- 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 C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
 - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: Brown.

2.02 FABRICATION

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

2.03 ACCESSORIES

- A. Primer Type: Zinc chromate.
- B. Concealed Sealants: Non-curing butyl sealant.
- C. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- D. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- E. Reglets: Surface-mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Comply with drawing details.
- B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Install snow guards 18 inch up slope from eaves.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof ventilation louvers.

1.02 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 ROOF VENTS

- A. Roof Ventilation Louvers: Roof mounted, with drainable louver blades in rectangular profiles.
 - 1. Louver Profile: Rectangular.
 - 2. Size: 12 inches by 12 inches.
 - 3. Material:
 - a. Aluminum: Comply with ASTM B209/B209M.
 - b. Color: Brown (to match flashing).
 - 4. Products:
 - a. CopperCraft; Louver 750: www.coppercraft.com.
 - b. GAF; Master Flow Roof Louver: www.gaf.com.
 - c. Air Vent; SLA Slant Back: www.airvent.com.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

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

3.04 CLEANING

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

3.05 PROTECTION

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

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 8. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Dow Corning Corporation: www.dowcorning.com/construction.
 - 3. Pecora Corporation: www.pecora.com.
 - 4. Sika Corporation: www.usa-sika.com.
 - 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 - 6. W.R. Meadows, Inc: www.wrmeadows.com.

- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Dow Corning Corporation: www.dowcorning.com/construction.
 - 3. Pecora Corporation: www.pecora.com.
 - 4. Sika Corporation: www.usa-sika.com.
 - 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 - 6. W.R. Meadows, Inc: www.wrmeadows.com.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
 - 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 - 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 - 6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 - 7. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Color: Match adjacent finished surfaces.
 - 5. Service Temperature Range: Minus 65 to 180 degrees F.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: Confirm color by application/location with Architect prior to application.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's custom range.
- D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
 - 1. Movement Capability: Plus and minus 35 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's custom range.
- E. Polysulfide Sealant for Continuous Water Immersion: Polysulfide; ASTM C920, Grade NS, Uses M and A; single component; explicitly approved by manufacturer for continuous water immersion; not expected to withstand traffic.

1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Color: To be selected by Architect from manufacturer's custom range.
- F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
- G. Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.
- H. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.04 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
- B. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multi-component, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Joint Width, Minimum: 1/8 inch.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

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

3.04 FIELD QUALITY CONTROL

- A. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Accessories, including louvers.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- J. ASTM C476 - Standard Specification for Grout for Masonry; 2019.
- K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- M. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.
- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 3. Steward Steel, Inc.: www.stewardsteeldoors.com/#sle
 - 4. Any listed member of NAAMM HMMA in good standing; www.naamm.org/hmma..

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 4. Door Edge Profile: Beveled, both sides.
 5. Door texture: Smooth faces.
 6. Typical Door Face Sheets: Flush.
 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Non-insulated.
1. Based on NAAMM HMMA Custom Guidelines:
 - a. Comply with guidelines of NAAMM HMMA 861 for Commercial Hollow Metal Doors and Frames.
 - b. Performance Level 2 - Moderate Duty, in accordance with NAAMM HMMA 805.
 - c. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 - e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inches, nominal.
 4. Weatherstripping: Integral, recessed into door edge or frame.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Face welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- D. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- E. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Louvers: Roll formed steel with concealed frame; finish same as door components .
- B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 087100.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- E. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on Sheet A-101.

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

- A. BHMA A156.1 - American National Standard for Butts and Hinges; 2016.
- B. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.
- C. BHMA A156.6 - American National Standard for Architectural Door Trim; 2015.
- D. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2017.
- E. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.
- F. BHMA A156.18 - American National Standard for Materials and Finishes; 2016.
- G. BHMA A156.21 - American National Standard for Thresholds; 2014.
- H. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2017.
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- C. Keying Requirements Meeting:
 - 1. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - 2. Agenda:
 - a. Establish keying requirements.

- b. Verify locksets and locking hardware are functionally correct for project requirements.
3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 1. Provide complete description for each door listed.
 2. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
- D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 1. Lock Cylinders: One for each master keyed group.
 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 1. Closers: Five years, minimum.
 2. Locksets and Cylinders: Three years, minimum.
 3. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
- D. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 - 3. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

- A. Manufacturers:
 - 1. McKinney; an Assa Abloy Group company: www.assaabloyds.com.
 - 2. Bommer Industries, Inc: www.bommer.com.
 - 3. C. R. Laurence Co., Inc: www.crl-arch.com/#sle.
 - 4. Hager Companies: www.hagerco.com.
 - 5. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com.
 - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
 - 1. Provide hinges on every swinging door.
 - 2. Provide non-removable pins on exterior outswinging doors.
 - 3. Provide following quantity of butt hinges for each door:
 - a. Doors From 60 inches High up to 90 inches High: Three hinges.

2.03 FLUSH BOLTS

- A. Flush Bolts: Comply with BHMA A156.16, Grade 1.
 - 1. Flush Bolt Throw: 3/4 inch, minimum.
 - 2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.

3. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.

2.04 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 1. Provide cylinders from same manufacturer as locking device.
 2. Provide cams and/or tailpieces as required for locking devices.
 3. Coordinate cylinder type and keying standards with owner.

2.05 MORTISE LOCKS

- A. Manufacturers:
 1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
 2. Best, dormakaba Group: www.bestaccess.com.
 3. Hager Companies: www.hagerco.com.
 4. Schlage, an Allegion brand: www.allegion.com/us.
 5. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 1. Latchbolt Throw: 3/4 inch, minimum.
 2. Deadbolt Throw: 1 inch, minimum.
 3. Backset: 2-3/4 inch unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 5. Occupancy Indicators: Provide occupancy indicators on all restroom doors on exterior side keyed on exterior with thumb turn on interior.
 6. Trim: Provide ADA-compliant lever handle or pull trim on both sides of each lock, unless otherwise indicated.

2.06 COORDINATORS

- A. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.07 CLOSERS

- A. Manufacturers; Surface Mounted:
 1. Corbin Russwin, Norton, Rixson, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
 2. DORMA USA, Inc; 7400 Series, 8600 Series, 8900 Series, and TS93: www.dorma.com.
 3. Hager Companies: www.hagerco.com.
 4. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com.
 5. Substitutions: See Section 006325 - Product Substitution Request.

- B. Closers: Comply with BHMA A156.4, Grade 1.
 - 1. Type: Surface mounted to door.
 - 2. Provide door closer on each exterior door.
 - 3. At outswinging exterior doors, mount closer on interior side of door.

2.08 PROTECTION PLATES

- A. Manufacturers:
 - 1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 - 2. C. R. Laurence Company, Inc: www.crl-arch.com.
 - 3. Hager Companies: www.hagerco.com.
 - 4. Ives, an Allegion brand: www.allegion.com/us.
 - 5. Substitutions: See Section 006325 - Product Substitution Request.
- B. Protection Plates: Comply with BHMA A156.6.
- C. Edges: Beveled, on four sides unless otherwise indicated.
- D. Fasteners: Countersunk screw fasteners.
- E. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.09 KICK PLATES

- A. Kick Plates: Provide along bottom edge of push side of every door with closer of restroom doors.
 - 1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.10 WALL STOPS

- A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Type: Bumper, concave, wall stop.
 - 2. Material: Stainless steel housing with rubber insert.

2.11 ASTRAGALS

- A. Astragals: Comply with BHMA A156.22.
 - 1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 2. Type: Split, two parts, and with sealing gasket.
 - 3. Material: Aluminum, with neoprene weatherstripping.
 - 4. Provide non-corroding fasteners at exterior locations.

2.12 THRESHOLDS

- A. Manufacturers:
 - 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Hager Companies: www.hagerco.com.
 - 3. National Guard Products, Inc: www.ngpinc.com.

4. Substitutions: See Section 016000 - Product Requirements.
- B. Thresholds: ADA Compliant, comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Type: Flat surface.
 3. Material: Aluminum.
 4. Threshold Surface: Fluted horizontal grooves across full width.
 5. Field cut threshold to profile of frame and width of door sill for tight fit.
 6. Provide non-corroding fasteners at exterior locations.

2.13 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. National Guard Products, Inc: www.ngpinc.com.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Steel, with brush weatherstripping.
 4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.14 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.15 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
1. Primary Finish: 613; dark oxidized satin bronze, oil rubbed, with bronze base material (former US equivalent US10B); BHMA A156.18.
 2. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

- B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
- D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

3.05 PROTECTION

- A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 087100

SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Exposed surfaces of steel lintels and ledge angles: Refer to Section 09 9600 - High Performance Coatings.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Concealed pipes, ducts, and conduits.
 - 7. Exterior masonry or stone, unless otherwise indicated.

1.02 REFERENCE STANDARDS

- A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- D. SSPC-SP 1 - Solvent Cleaning; 2015.
- E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 3. Paint color submittals may not be considered until color submittals for major materials not to be painted, such as masonry, siding, and shingle roofing, have been approved.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 2. Label each container with color in addition to the manufacturer's label.
 3. Contractor's option: Provide extra paint and finish materials as a credit at the store(s) where material(s) are available.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 1. Behr Process Corporation: www.behr.com.

2. Diamond Vogel Paints: www.diamondvogel.com.
3. PPG Paints: www.ppgpaints.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Finished, Unless Otherwise Indicated: Including fiber cement siding.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 3. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Latex Primer for Exterior Wood; MPI #6.
 2. Fiber Cement: As recommended by siding manufacturer.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Fiber Cement Siding: 12 percent or as required by siding manufacturer.
 - 2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean concrete according to ASTM D4258. Allow to dry.
- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- I. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.

- 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Refer to Section 09 9600 - High Performance Coatings for scope in that section.
 - 2. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 3. Prime surfaces to receive wall coverings.
 - 4. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and HVAC grilles in gypsum wall assemblies, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convactor and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- C. SSPC-SP 1 - Solvent Cleaning; 2015.
- D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, wood cabinets, and wood doors, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 2. Label each container with color in addition to the manufacturer's label.
 - 3. Contractor's option: Provide extra paint and finish materials as a credit at the store(s) where material(s) are available.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com.
 - 2. Diamond Vogel Paints: www.diamondvogel.com.
 - 3. PPG Paints: www.ppgpaints.com.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units, wood, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Two top coats and one coat primer.

2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 2. Interior Latex Primer Sealer; MPI #50.
 3. Interior Drywall Primer Sealer.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Masonry:
 1. Prepare surface as recommended by top coat manufacturer.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

- H. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- I. Galvanized Surfaces:
- J. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

- A. Concrete, Concrete Masonry Units (CMU), Concrete Block, Brick Masonry: Finish surfaces exposed to view.
 - 1. Interior: CI-OP-3L, semi-gloss.
- B. Wood: Finish surfaces exposed to view.
 - 1. Interior trim and frames: WI-OP-3A, semi-gloss.
- C. Steel Doors and Frames: Finish surfaces exposed to view; MI-OP-3A, gloss.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High performance coatings.
- B. Surface preparation.
- C. Scope: Exterior coatings and all metal surfaces within interior pool mechanical environment, unless factory-finished or otherwise indicated.
 - 1. Mechanical, Electrical, Fire Protection, and Audio Visual within interior natatorium environment:
 - a. Paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - 2. Do Not Paint or Finish the Following Items:
 - a. Items factory-finished unless otherwise indicated; material and products having factory applied primers at not considered to be factory-finished.
 - b. Items indicated to receive other finishes.
 - c. Items indicated to remain unfinished.
 - d. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - e. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - f. Floors, unless specifically indicated.
 - g. Glass.
 - h. MEPP services in mechanical or storage spaces unless specifically indicated.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- B. SSPC-SP 1 - Solvent Cleaning; 2015.
- C. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- D. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with concrete floor placement and concrete curing, for compatibility of substrates.
 - 2. Coordinate work with priming of steel products to receive coatings, for compatibility of primed substrates.
- B. Preinstallation Meeting: Convene one week before starting work of this section. Require attendance by all relevant installers.
 - 1. Convene under general provisions of Section 01 3100.
 - 2. Review the following:
 - a. Environmental requirements.
 - b. Protection of surfaces not scheduled to be coated.
 - c. Surface preparation.
 - d. Application methods and procedures.
 - e. Repair methods and procedures.
 - f. Field quality control.
 - g. Cleaning methods and procedures.
 - h. Protection of coating systems.
 - i. One year inspection requirements.

1.05 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
- C. Samples: Submit two samples 8 by 8 inch in size illustrating colors for confirmation.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include cleaning procedures and repair and patching techniques.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Coating Materials: 1 gallon of each type and color.
 - 2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.
- B. Basis of Design: Specifications are based on coating types by specified basis of design manufacturer and products. Coating types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation and performance are minor, and do not detract substantially from the indicated design intent.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- F. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:
 - 1. Tnemec Company, Inc.: www.tnemec.com

- a. Paint Systems: As specified in this section for each application.
- B. Acceptable Manufacturers:
- 1. PPG Paints: www.ppgpaints.com.
 - 2. Comex Group: www.thecomexgroup.com.
 - 3. Carboline Company: www.carboline.com.

2.02 HIGH-PERFORMANCE COATING MATERIALS

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- 1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
 - 2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.
 - 3. Colors: As indicated.
- B. Polyurethane Coating - Type A: Three coats, aliphatic acrylic polyurethane, semi-gloss finish.
- 1. Applications: All field- or shop-primed and galvanized steel members at exterior, all exterior doors and frames scheduled for paint finish, and other locations or materials as indicated on the Drawings.
 - 2. Product Characteristics:
 - a. Percentage of Solids by Volume: 65, minimum.
 - b. Dry Film Thickness, Total System: 9.0 to 13.0, minimum.
 - c. Water Vapor Permeance: 0.17 perms according to ASTM D1653.
 - 3. Acceptable Finish Coating Product: Series 1075 Endura-Sheild II manufactured by Tnemec Company, Inc..
 - a. Intermediate Coat Product: L69 Hi-Build Epoxoline II manufactured by Tnemec Company, Inc.; 2 coats, DFT 6.0 to 9.0, minimum.
 - 1) Color: Same color family as finish coat but noticeably different.
 - 4. Base Primer on Shop-Primed Galvanized Ferrous Metal: As recommended by intermediate coat product manufacturer.
 - a. Verify compatibility of base primer with specified intermediate coat product.
 - 5. Base Primer on Field-Primed Galvanized Ferrous Metal: As recommended by intermediate coat product manufacturer.
 - a. Prepare substrate in strict accordance with Part 3 and manufacturer instructions to maintain coating warranty.
- C. High-Build Epoxy Coating - Type B: Three coats, water-base epoxy, semi-gloss finish.
- 1. Applications: Exposed concrete and concrete masonry surfaces scheduled for paint finish at foundation walls and in restrooms, shower rooms, storage rooms, mechanical rooms, and other locations as indicated on Drawings.
 - 2. Product Characteristics:
 - a. Percentage of Solids by Volume: 100, minimum.
 - b. Dry Film Thickness, Total System: 16.0 to 25.0, minimum.
 - c. Water Vapor Permeance: 0.17 perms according to ASTM D1653.
 - 3. Acceptable Finish Coating Product: L69 Hi-Build Epoxoline II manufactured by Tnemec Company, Inc..
 - a. Finish: 2 coats, 3 to 5 mil DFT each coat.
 - b. System Primer Products:

- 1) Primer Coat: Series 130 Envirofill cementitious acrylic masonry filler; DFT 10.0 to 15.0, minimum.
- 2) Intermediate Coat: L69 Hi-Build Epoxoline II manufactured by Tnemec Company, Inc.; DFT
- 3) 3.0 to 5.0, minimum.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.
- B. Masonry Filler: Vehicle and resin compatible with topcoats, Portland cement and sand, formulated for applied thickness of 30-40 mils.
- C. Shellac: Pure white type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- F. Test shop-applied primer for compatibility with subsequent cover materials.
- G. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
- H. Masonry: Verify masonry joints are struck flush.
- I. Proceed with coating application only after unacceptable conditions have been corrected.
 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.

- D. Existing Painted and Sealed Surfaces:
 1. Strip existing paint and coatings from surface.
 2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
- E. Masonry:
 1. Prepare surface as recommended by coating manufacturer.
- F. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1 and prepare surface as recommended by coating manufacturer.
- G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.
 1. Restrictions: Do not use passivation materials or rinses that will leave detrimental residue.
 2. Brush Blast Cleaning of Galvanized Surfaces: Remove tight rust to bare metal using brush blast cleaning, and remove all visible oil, grease, dirt, dust, loose mill scale, loose rust, passivation materials, and loose coatings according to ASTM D6386 and SSPC-SP 7, and protect from corrosion until coated.
- H. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Confirm compatibility of primer with topcoat. Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.
- I. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

- B. Contractor to provide field inspection for the following:
 - 1. Verify coatings and other materials are as specified.
 - 2. Verify surface preparation and application are as specified.
 - 3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
 - 4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - 5. Report:
 - a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
 - b. Report nonconforming work not corrected.
 - c. Submit copies of report to Architect and Contractor.

- C. Manufacturer's Field Services: Manufacturer's representative will provide technical assistance and guidance for surface preparation and application of coating systems.

3.06 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

- A. Protect finished work from damage.

END OF SECTION 099600

SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room identification signs.
- B. Building identification signs.

1.02 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.03 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

- A. Accessibility Compliance for Room ID Signs: Signs are required to comply with ADA Standards, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Building Identification Signs:
 - 1. Use individual metal letters stud mounted.
 - 2. Mount on outside wall in location indicated on drawings.

2.02 SIGN TYPES

- A. Room Identification:
 - 1. Applications: Provide sign for each restroom and storage room.
 - 2. Material: Bronze.
 - 3. Color and Font: Unless otherwise indicated:
 - a. Character Font: Futura, or other sans serif font to be confirmed by Architect.
 - b. Character Case: Upper case only.
 - c. Background Color: Clear.
 - d. Character Color: Contrasting color.

2.03 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Metal: Bronze sheet, flat.
 - 2. Metal Thickness: 1/8 inch minimum.
 - 3. Letter Height: As indicated on drawings.
 - 4. Text and Typeface:
 - a. Character Font: Futura, or other sans serif font to be confirmed by Architect.
 - b. Character Case: Upper and lower case (title case).
 - 5. Finish: Brushed, satin.
 - 6. Mounting: As indicated on drawings.

2.04 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION 101400

SECTION 101446 - CHEMICAL SIGNS FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chemical signs.
- B. Chemical caution signs.
- C. NFPA hazardous materials signs.

1.2 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for sign types specified, including components and accessories.
- C. Shop Drawings: Indicate location of each individual sign in the project.
- D. Manufacturer's Instructions: Printed installation instructions for each product.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Provide signs in accordance with regulatory authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products of this section in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: Seton Identification Products; 20 Thompson Road, Branford CT 06405-2842; Telephone 203-488-8059, FAX 203-488-5973; Toll Free Telephone 800-243 6624, Toll Free FAX 800-345-7819.
- B. Acceptable manufacturers:
 - 1. Uline: www.Uline.com

2. Emedco: www.Emedco.com

2.2 SIGNS

A. Chemical Signs:

1. Product: Seton Style M34xx or M35xx.
2. Material: Tedlar Coated Plastic.
3. Size: 10 inches wide by 14 inches high.

B. Chemical Caution Signs:

1. Product: Seton Style M9157.
2. Material: Aluminum.
3. Size: 10 inches wide by 7 inches high.
4. Legend: "CAUTION CHEMICAL STORAGE AREA AUTHORIZED PERSONNEL ONLY".

C. NFPA Signs:

1. Material: Aluminum.
2. Colors: As required by National Firefighters Prevention Association (NFPA) #704-1996, Standard System for the Identification of the Fire Hazards of Materials.
3. Size: 15 inches square.

2.3 ACCESSORIES

- A. Mounting Hardware: Brass screws.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces to receive signs have been finished, and that finishes are dry and correctly cured.

3.2 INSTALLATION

- A. Install signs in accordance with manufacturer's printed installation instructions.
- B. Locate signs in accordance with regulatory authorities having jurisdiction.

3.3 SCHEDULES

- A. General: Provide signs approved by the local fire officials which indicates that the contents are potentially dangerous.
- B. Colors: As required by regulatory authorities having jurisdiction.
- C. Sign Schedule:
 - 1. Filter Building:
 - a. Chemical Sign for Sodium Hypochlorite: Wall Adjacent to Chemical Feeders.
 - b. Chemical Sign for Muriatic Acid: Wall Adjacent to Chemical Feeders.
 - c. Chemical Caution Sign: All Doors to Chemical/Filter Room.
 - d. NFPA Sign for Sodium Hypochlorite: All Doors to Chemical/Filter Room.
 - e. NFPA Sign for Muriatic Acid: All Doors to Chemical/Filter Room.

END OF SPEC SECTION 101446

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Electric hand/hair dryers.
- D. Diaper changing stations.
- E. Utility room accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.
- 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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- D. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2013.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
- H. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2016).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

- A. See Section 01 3300 - Submittals, for submittal procedures.

- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com.
 - 2. Bradley Corporation: www.bradleycorp.com.
 - 3. Bobrick Washroom Equipment: www.bobrick.com.
- B. Under-Lavatory Pipe Supply Covers:
 - 1. Plumberex Specialty Products, Inc: www.plumberex.com.
 - 2. Truebro: www.ipsplumbingproducts.com/brands/truebro.
 - 3. Oatey: www.oatey.com.
- C. Electric Hand/Hair Dryers:
 - 1. Excel Dryer: www.exceldryer.com.
 - 2. World Dryer Corporation: www.worlddryer.com.
 - 3. Bobrick Washroom Equipment: www.bobrick.com.
- D. Child Care Accessories:
 - 1. Diaper Changing Stations:
 - a. American Specialties, Inc: www.americanspecialties.com.
 - b. Bradley Corporation: www.bradleycorp.com.
 - c. Koala Kare Products: www.koalabear.com.
- E. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Keys: Provide 2 keys for each accessory to Owner.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Zinc Alloy: Die cast, ASTM B86.
- G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

- H. Adhesive: Two component epoxy type, waterproof.
- I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.04 Commercial Toilet Accessories

- A. Toilet Paper Dispenser: Double roll, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
 - 1. Products:
 - a. Bobrick B-2888.
 - b. ASI 0300.
 - c. Bradley 5402
- B. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
 - 1. Products:
 - a. Bobrick B-4112.
 - b. ASI 9343.
 - c. Bradley 6542.
- C. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Size:
 - a. Rectangular: 24 inches wide x 36 inches high
 - 2. Frame: 0.04 inch channel shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
 - 4. Products:
 - a. Bobrick B-165.
 - b. ASI 0620.
 - c. Bradley 781.
- D. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Length and Configuration: As indicated on drawings.
 - c. Products:

- 1) Bobrick B-6806 x length.
- 2) ASI 3800.
- 3) Bradley 812.

- E. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
 - a. Bobrick B-270.
 - b. ASI 0852.
 - c. Bradley 4A10-11.

2.05 Electric Hand/Hair Dryers

- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
1. Operation: Automatic, sensor-operated on and off.
 2. Cover: Epoxy painted steel or die-cast zinc alloy.
 - a. Color: White.
 - b. Tamper-resistant screw attachment of cover to mounting plate.
 3. Electric Hand Dryer Products:
 - a. Excel Dryer Inc; XLERATOReco with ADA compliant recess kit.
 - b. Bobrick Washroom Equipment; QuietDry Series TrimDry; B-7128.
 - c. World Dryer Corporation; SLIMdri.

2.06 CHILD CARE ACCESSORIES

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Stainless steel.
 2. Mounting: Surface.
 3. Minimum Rated Load: 250 pounds.
 4. Products:
 - a. Bradley Corporation; Model 962-11..
 - b. Koala Kare Products; Model KB300-SS..
 - c. American Specialties, Inc.; Model 9013-9..
 - d. Substitutions: 016000 - Product Requirements.

2.07 Utility Room Accessories

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
1. Hooks: 4, 0.06 inch stainless steel rag hooks at shelf front.
 2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 3. Length: Manufacturer's standard length for number of holders/hooks.
 4. Products:
 - a. Bobrick B-239.
 - b. ASI 1308-3.
 - c. Bradley 9933.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: As indicated on drawings.
 - 2. Electric Hand Dryers: Measured from floor to bottom of nozzle:
 - a. Handicap: 36 inches.
 - 3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 116800 - PLAYGROUND EQUIPMENT AND STRUCTURES – ALTERNATE No.2

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all playground equipment.

1.2 REFERENCES

- A. ASTM F223-19a– Standard Guide for ASTM Standards on Playground Surfacing
- B. ASTM F1487-01 – Standard Consumer Safety Performance Specification for Playground Equipment for Public Use.
- C. Consumer Product Safety Council (CPSC) Handbook for Public Playground Safety.

1.3 QUALITY ASSURANCE

- A. Certification
 - 1. Certifications for UV stability, material handling to include physical and chemical properties and stability and reactivity.
- B. Other
 - 1. Installer’s Qualifications: Must be a certified playground installer with not less than five years’ experience in the assembly and installation of playground equipment of the type proposed for the work or supervised in the field by a representative of the manufacturer.
 - 2. Drawings: complete shop drawings, including installation details, dimensions, interface, or attachment to adjacent work, fastening and anchoring methods of all system components, detail and location of joints, and notation or identification of finishes for work specified herein.
 - 3. The Contractor shall notify Owner's Representative of any discrepancies of site dimensions, obstructions, etc. that are not shown in the drawings and that might not have been known during preparation of drawings. If such notification is not made, Contractor shall assume all expenses and responsibility for any revisions necessary. Work called for on the drawings by notes or on details shall be furnished and installed whether specifically mentioned in the specifications.

1.4 GUARANTEE

- A. Warranty
 - 1. During the period of ten (10) full years after the final payment of work, make all necessary repairs or replacements due to defective workmanship or materials within thirty (30) calendar days of receipt of notice of malfunction by the Owner.

1.5 ACTION SUBMITTALS

- A. Product Data: For each piece of equipment, including color and texture, proposed.
- B. Shop Drawings: For overall playground layout and each proposed piece of equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include fall heights and use zones for playground equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturers
 - 1. Landscape Structures, Inc.
 - a. Address: 601 7th Street South, Delano, Minnesota 55328
 - b. Phone: 1-800-328-0035
 - c. Website: <https://www.playlsi.com>
 - 2. Kompan, Inc.
 - a. Address: 605 West Howard Lane, Austin, Texas 78753
 - b. Phone: 1-800-426-9788
 - c. Website: <https://www.kompan.us>
 - 3. GameTime
 - a. Address: 150 PlayCore Drive Southeast, Fort Payne, Alabama 35967
 - b. Phone: 1-800-438-2780
 - c. Website: <https://www.gametime.com>
 - 4. BCI Burke Company
 - a. Address: 665 North Peters Avenue, Fond du Lac, Wisconsin 54937
 - b. Phone: 1-800-266-1250
 - c. Website: <https://www.bciburke.com>

2.2 PLAY EQUIPMENT

- A. Slide
 - 1. Maximum Fall Height: 72 inches.
 - 2. Acceptable Materials:
 - a. Galvanized Steel (frame)
 - b. Rotomolded polyethylene (slide)
 - c. Polyester-reinforced textured rubber (bridging or belting)
 - d. Steel reinforced cables (cables and netting)
 - 3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Tan
 - d. Black
 - e. Gray
- B. Multi-Climber

1. Maximum Fall Height: 96 inches.
2. Acceptable Materials:
 - a. Galvanized Steel (frame)
 - b. Rotomolded polyethylene (balance pods)
 - c. Polyester-reinforced textured rubber (bridging or belting)
 - d. Steel-reinforced cables (cables and netting)
 - e. Recycled plastic (panels)
3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Tan
 - d. Black
 - e. Gray

C. Spinner

1. Maximum Fall Height: 18 inches.
2. Acceptable Materials:
 - a. Galvanized Steel (frame)
 - b. Steel reinforced cables (cables and netting)
3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Blue
 - d. Yellow

D. Balance Elements (2)

1. Maximum Fall Height: 15 inches.
2. Acceptable Materials:
 - a. Galvanized Steel (frame)
 - b. Robinia Wood (frame)
 - c. Recycled Plastic Lumber (beam)
 - d. HDPE (beam)
3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Tan
 - d. Black
 - e. Gray

E. Stepping Elements (8)

1. Maximum Fall Height: 24 inches.
2. Acceptable Materials:
 - a. Galvanized Steel (frame)
 - b. Robinia Wood (frame)
 - c. Recycled Plastic Lumber (beam)
 - d. HDPE (beam)
3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Red
 - d. Yellow

- F. Bouncing, Springing, or Wobbling Elements (3)
 - 1. Maximum Fall Height: 30 inches.
 - 2. Acceptable Materials:
 - a. Galvanized Steel (frame and springs)
 - b. Robinia Wood (frame)
 - c. Recycled Plastic Lumber (beam)
 - d. HDPE (panels)
 - 3. Acceptable Colors:
 - a. Green
 - b. Brown
 - c. Red
 - d. Yellow

2.3 MATERIALS

- A. All materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts using time-tested coatings such as zinc plating, galvanizing, powder coating, etc.
- B. Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated. All primary fasteners shall include a locking patch type material that will meet minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.
- C. Powder Coating: Metal components to be powder coated shall be thoroughly cleaned in a hot phosphatizing wash system, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees. The finished coating shall be approximately 0.08” thick at an 85 durometer with a minimum tensile strength of 1700 psi and a minimum tear strength of 250 pounds per inch.
- D. Hot Dipped Galvanized (HDG) Steel: Steel components to be Hot Dipped Galvanized shall be thoroughly cleaned of organic compounds and dirt through complete immersion in a hot alkali solution. Cleaned parts shall undergo acid pickling to remove rust or scale. All parts shall then be fluxed to eliminate surface oxides and promote intermetallic development. Prepped parts shall then be submerged in a bath of molten zinc until the part reaches 840° F and the zinc reacts to form zinc/iron intermetallic layers on all surfaces inside and out. Hot Dipped Galvanized Parts shall be manufactured and inspected according to ASTM A123.
- E. Decks: All decks shall be of modular design and have 5/16" diameter holes on the standing surface. There shall be a minimum of (4) slots in each face to accommodate face mounting of components. Decks shall be manufactured from a single piece of low carbon 12 GA (.105") sheet steel conforming to ASTM specification A-1011. The sheet shall be perforated with a return flange on the perimeter to provide the reinforcement necessary to ensure structural integrity. There shall be no unsupported area larger than 3.5 square feet. Decks shall be designed so that all sides are flush with the outside edge of the supporting posts.
- F. Rotationally Molded Polyethylene Parts: These parts shall be molded using prime natural linear low-density polyethylene having a tensile strength of 2400 psi per ASTM D638. Rotational

molding resin is compounded with color and UV-stabilizing additives with a nominal wall thickness typically 1/4" with some variation depending upon product type.

- G. Recycled Plastic Panels: These parts shall be manufactured from 3/4" high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI per ASTM D638. Available in a three-layer product with (2) .100" thick colored exterior layers over a .550" thick recycled Black interior core.
- H. Footings: Unless otherwise specified, the bury on all footings shall be 34" below finished grade on all in-ground play elements and posts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations indicated in shop drawings.
 - 1. Comply with manufacturer's instructions for size and structural requirements of playground equipment footings.
 - 2. Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor to engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Perform testing and inspection for each type of installed playground equipment according to ASTM F 1487.
- C. Playground equipment items will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 116800

SECTION 131114 - WATERSTOP FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provisions of waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.
- B. Waterstops for pipe penetrations.

1.2 RELATED SECTIONS

- A. Section 13 11 15 - Cast-in-Place Concrete for spray grounds.

1.3 REFERENCES

- A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension; 1998a.
- B. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000.
- C. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2000.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Samples: Submit two waterstop samples, each 6 inches long.
- C. Product Data: Submit data of complete physical properties.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Store waterstops under cover and elevated above grade to protect from oil, dirt, sunlight, and premature exposure to water.

PART 2 PRODUCTS

2.1 HYDROPHILIC WATERSTOPS

- A. Manufacturers and Products:

1. Construction Joints:
 - a. Greenstreak "Hydrotite" profile number CJ-0725-3K.
 - b. Applications: Use at all construction joints where called for on the drawings.
 - c. Acceptable manufacturers:
 - 1) Adeka: www.ocm-inc.com
 - 2) De Neef: www.gcpat.com
 2. Penetrations:
 - a. Greenstreak "Hydrotite" profile number DSS-0420.
 - b. Applications: Use at all pipe or other penetrations through water holding concrete structures.
 - c. Acceptable manufacturers:
 - 1) Adeka: www.ocm-inc.com
 - 2) De Neef: www.gcpat.com
- B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
- C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
- D. Performance requirements as follows:
1. Chloroprene Rubber:
 - a. Tensile Strength, ASTM D 412: 1,300 psi minimum.
 - b. Ultimate Elongation, ASTM D 412: 400 percent minimum.
 - c. Hardness (Shore A), ASTM D 2240: 50 plus or minus 5.
 - d. Tear Resistance, ASTM D 624: 100 lb/inch minimum.
 2. Modified Chloroprene (Hydrophilic) Rubber:
 - a. Tensile Strength, ASTM D 412: 350 psi minimum.
 - b. Ultimate Elongation, ASTM D 412: 600 percent minimum.

- c. Hardness (Shore A), ASTM D 2240: 52 plus or minus 5.
- d. Tear Resistance, ASTM D 624: 50 lb/inch minimum.
- e. Expansion Ratio, Volumetric Change - Distilled Water @ 70 degrees F: 3 to 1 minimum.

2.2 ACCESSORIES

A. Hydrophilic Waterstops:

- 1. Provide Greenstreak Rubber Adhesive to secure "Hydrotite" to smooth, dry concrete.
- 2. Provide Greenstreak "Epoxy 7300" two component epoxy gel to secure "Hydrotite" to rough, wet (or dry) concrete.
- 3. Provide "Leakmaster LV-1" single component hydrophilic sealant to secure "Hydrotite" to rough, dry concrete.
- 4. Provide cyanacrylate adhesive (super glue) for all splices.
- 5. Provide "Leakmaster LV-1" as addition to cyanacrylate adhesive at all splices for added insurance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hydrophilic Waterstop:

- 1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
- 2. Splices shall be sealed using cyanacrylate adhesive (super glue) and "Leakmaster LV-1".
- 3. Seal watertight any exposed cells of "Hydrotite" using "Leakmaster LV-1".
- 4. Follow approved manufacturer recommendations.

B. PVC and Hydrophilic Intersections:

- 1. Maintain continuity of waterstops at all intersections and transitions.
- 2. Joinery between PVC and "Hydrotite" shall be sealed using "Leakmaster LV-1".

3. Follow approved manufacturer recommendations.

END OF SPEC SECTION 131114

SECTION 131115 - CAST-IN-PLACE CONCRETE FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete formwork.
- B. Elevated concrete slabs.
- C. Floors and slabs on grade.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Concrete curing.

1.2 RELATED REQUIREMENTS

- A. Section 13 11 14 - Waterstops for spray grounds

1.3 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 224R - Control of Cracking in Concrete Structures; 2001.
- C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- F. ACI 304.2R - Placing Concrete by Pumping Methods; 1991.
- G. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- H. ACI 309R - Guide for Consolidation of Concrete; American Concrete Institute International; 1987.

- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.
- K. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1999a.
- L. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field; 2000.
- M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a.
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2012.
- O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2011b.
- P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2010a.
- Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2010b.
- S. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 1997.
- T. ASTM C 1064 - Test Method for Temperature of Freshly Mixed Portland Cement Concrete; 1999.
- U. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 1995.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Submit data on formwork, reinforcing, and reinforcing accessories.
 - 2. Submit data on all concrete materials including cement and fine and coarse aggregates. Testing shall be completed by an independent testing agency and shall be less than 12 months old. The costs for material tests shall be paid for by the Contractor.
 - 3. Submit data on all admixtures and concrete accessories.

4. Submit concrete mix design.
- C. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

1.5 DESIGN OF FORMWORK

- A. Design and engineering of formwork, as well as its construction shall be the responsibility of the Contractor and shall comply with chapters 2 and 3 of ACI-347, and applicable requirements of the controlling local building code.

1.6 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Acquire cement from same source and aggregate from same source for entire project.
- C. Cold Weather Concreting: Cold weather concreting shall comply with ACI 306R.
1. The temperature of concrete at the time of placement shall be as follows:
 - a. Section size (minimum dimension) less than 12 inches: 55 to 75 degrees F.
 - b. Section size (minimum dimension) 12 to 36 inches: 50 to 70 degrees F.
 2. The concrete temperature shall be maintained above the minimum identified above for a period of 6 days after placement.
- D. Hot Weather Concreting: Except as modified herein, hot weather concreting shall comply with ACI 305R.
1. At air temperatures of 90 degrees F or above, concrete shall be kept as cool as possible during placement and curing. The temperature of the concrete when placed in the work shall not exceed 90 degrees F.
 2. Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or exceeds 0.2 pound per square foot per hour, as determined by Figure 2.1.5 in ACI 305R.
- E. Concrete materials shall be selected and concrete shall be proportioned, handled, placed, and cured in a manner that will minimize shrinkage and cracking in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled both before and after placement to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled with blankets or other acceptable means of insulation.

1.7 MOCK-UP

- A. Construct a mock-up panel for each type of concrete surface finish for review and acceptance by Engineer.
 - 1. Panel Size: Sufficient to illustrate finish required.
 - 2. Mock-up panels shall include, but not necessary limited to, illustrating the following:
 - a. Spray ground deck broom finish.
- B. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
- C. Mock-up shall not remain as part of the Work.

PART 2 PRODUCTS

2.1 FORMWORK

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Prefabricated: Simplex "Industrial Steel Frame Forms", Symons "Steel Ply", or Universal "Uni-form".
 - 3. Plywood: Product Standard PS 1, waterproof, resin-bonded, exterior type Douglas fir, Panel Grade Designation B-B (concrete form), Class I.
 - 4. Fiberboard: ANSI/AHA A135.4, Class 1, tempered, water-resistant, concrete form hardboard.
 - 5. Lumber: Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
 - 6. Chamfer Strips: Clear white pine, surface against concrete planed or Vinylex Corporation chamfer strips made from plastic material.
 - 7. Radius Formers: Vinylex Corporation radius formers made from plastic material.
 - 8. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

- a. Burke "Spectrum Release Agent", L&M Chemical "Debond", Master Builders "Pro Cote", Nox-Crete "Chembeton", or Symons "Thrift Kote".
9. Form Ties: Cone snap type, with 1-1/2 inch long cone and waterproofing washer, that will leave no metal within 1-1/2 inches of concrete surface.

2.2 SPECIAL CONCRETE TOOLS & ACCESSORIES

A. Slab Finish Strip:

1. Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
2. Size: 20-inches wide by length required with 1-inch break.
3. Use: For use during concrete finishing process to create straight line separation between slabs and to protect adjacent concrete slabs from fresh concrete.

2.3 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).

1. Deformed billet-steel bars. Use plain billet-steel bars only where indicated on the drawings.
2. Finish: Unfinished, unless otherwise indicated.

B. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Precast Concrete Reinforcement Supports: Concrete supports that are not less than 4 inches square having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed may be used for supporting reinforcing from the ground per ACI 301.
4. Provide stainless steel or all-plastic (no plastic-tipped components allowed) components for placement within 1-1/2 inches of surfaces exposed to weather or water.

2.4 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

1. Acquire all cement for entire project from same source.
 2. Portland Limestone Cement (Type PLC or IL) per ASTM C595 and ASTM C1157 shall be allowed.
- B. Fly Ash: Shall not be allowed.
- C. Fine and Coarse Aggregates: ASTM C 33, unless modified herein.
1. Acquire all aggregates for entire project from same source.
 2. Fine Aggregate:
 - a. Clean natural sand. Artificial or manufactured sand will not be acceptable.
 - b. Shall not contain any materials that are deleteriously reactive with the alkalis in the cement.
 - c. Sulfate Soundness Test: ASTM C 88.
 - 1) Fine aggregate subjected to five cycles of the soundness test shall have a weighted average loss not greater than 10 percent when sodium sulfate is used or 15 percent when magnesium sulfate is used.
 - d. Organic Impurities Test: ASTM C 40.
 - 1) Fine aggregate shall be free of injurious amounts of organic impurities.
 - 2) Aggregates subjected to the test for organic impurities and producing a color darker than the standard shall be rejected.
 - e. Limits for Deleterious Substances:
 - 1) Clay lumps and friable particle, ASTM C 142: 3.0 percent.
 - 2) Materials finer than No. 200 sieve, ASTM C 117: 5.0 percent.
 - 3) Coal and lignite, ASTM C 123: 0.2 percent.
 - f. Sieve Analysis (percent passing), ASTM C 136:
 - 1) 3/8 inch: 100
 - 2) No. 4: 95 to 100
 - 3) No. 8: 80 to 100

- 4) No. 16: 50 to 85
 - 5) No. 30: 25 to 60
 - 6) No. 50: 15 to 30
 - 7) No. 100: 3 to 10
- g. Fineness Modulus, ASTM C 136: Shall not be less than 2.3 nor more than 3.1.
3. Coarse Aggregate:
- a. Crushed rock, washed gravel, or other inert granular material, having ASTM C 33 Class Designation 5S and as modified herein.
 - b. Shall not contain any materials that are deleteriously reactive with the alkalis in the cement.
 - c. Upper Limits for Deleterious Substances and Physical Property Requirements:
 - 1) Clay lumps and friable particles, ASTM C 142: 2.0 percent.
 - 2) Chert (less than 2.40 sp gr SSD), ASTM C 123: 0.5 percent.
 - 3) Material finer than No. 200 sieve, ASTM C 117: 1.0 percent.
 - 4) Coal and lignite, ASTM C 123: 0.2 percent.
 - 5) Abrasion, ASTM C 131: 50.
 - 6) Soundness Test, ASTM C 88:
 - (a) Magnesium sulfate (5 cycles): 18 percent.
 - (b) Sodium sulfate: 12 percent.
 - d. Grading Requirements:
 - 1) Type A Concrete Mix Design: ASTM C 33, Table 2 Size Number: 67, which has the following gradation (percent passing):
 - (a) 1 inch: 100
 - (b) 3/4 inch: 90 to 100
 - (c) 3/8 inch: 20 to 55

- (d) No. 4: 0 to 10
 - (e) No. 8: 0 to 5
 - 2) Type B Concrete Mix Design: ASTM C 33, Table 2 Size Number: 8, which has the following gradation (percent passing):
 - (a) 1/2 inch: 100
 - (b) 3/8 inch: 85 to 100
 - (c) No. 4: 10 to 30
 - (d) No. 8: 0 to 10
 - (e) No. 16: 0 to 5
- 4. Percentage of Fine to Total Aggregates: The ratio of fine to total aggregates, based on solid volumes (not weights), multiplied by 100 shall be based upon the following coarse aggregate sizes:
 - a. For 1 inch maximum coarse aggregate size: Ratio of fine to total aggregates is 30% to 46%.
 - b. For 1/2 inch maximum coarse aggregate size: Ratio of fine to total aggregates is 40% to 55%.
- D. Water: Clean and not detrimental to concrete.

2.5 CHEMICAL ADMIXTURES

- A. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable. Admixtures classified as Class 1 or Class 2 in ACI 212R or containing any lignosulfonic acids ("lignins") or their salts will not be acceptable.
- B. Air Entrainment Admixture: ASTM C 260.
 - 1. Products:
 - a. Grace "Daravair" or "Darex".
 - b. BASF "MB-VR" or "MB-AE 90".
 - c. Sika Chemical "AER".
 - 2. An air-entraining admixture shall be included in all concrete.

- C. Chemical Admixtures: ASTM C 494/C 494M, Type A - Water Reducing, Type B - Retarding, and Type D - Water Reducing and Retarding.
 - 1. Provide products manufactured by Grace, BASF, or Sika.
 - 2. A water reducing admixture shall be included in all concrete.
 - 3. A retarding admixture may be used only when approved by Engineer.

2.6 ACCESSORY MATERIALS

- A. Non-Shrink, Non-Metallic Grout: ASTM C 1107, Grades A, B, C; premixed compound consisting of non-metallic aggregate and portland cement.
 - 1. Minimum Compressive Strength at 28 Days: 7,000 psi.
 - 2. Products:
 - a. Carter Waters "CW 100 Precision Grout".
 - b. BASF "Masterflow 713 Plus".
 - c. Dayton Superior "1107 Advantage Grout".
 - d. Sonneborn "SonogROUT 10K".
- B. Epoxy Grout for Reinforcing Bars and Threaded Rod Anchors:
 - 1. Adhesive: Moisture-insensitive.
 - a. For Floors and Horizontal Surfaces:
 - 1) Low Viscosity Products:
 - (a) Hilti "HIT RE 500".
 - (b) Master Builders "Brutem AB (Parts A & B)".
 - (c) Sika "Sikadur 35, Hi-Mod LV" or "Sikadur 35, Hi-Mod LV LPL".

2.7 BONDING AND JOINTING PRODUCTS

- A. Waterstops for spray grounds: See Section 13 11 14.

2.8 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- 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 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Normal Weight Concrete, Type A:
 - 1. Type A concrete shall be used at all locations unless noted otherwise.
 - 2. Compressive Strength: The minimum acceptable compressive strength, when tested in accordance with ASTM C 39, shall be as follows:
 - a. 7 days: 3,000 psi.
 - b. 28 days: 4,000 psi.
 - 3. Cement Content: Minimum 530 lb per cubic yard.
 - 4. Water-Cement Ratio: Maximum 0.462 by weight.
 - 5. Total Air Content: 6 percent plus or minus 1 percent, per ASTM C 173.
 - 6. Slump: 3 inches plus or minus 1 inch.
 - 7. Maximum Aggregate Size: 1 inch.
- E. Normal Weight Concrete, Type B:
 - 1. Type B concrete shall be used only at specific locations shown.
 - 2. Compressive Strength: The minimum acceptable compressive strength, when tested in accordance with ASTM C 39, shall be as follows:
 - a. 7 days: 3,000 psi.
 - b. 28 days: 4,000 psi.
 - 3. Cement Content: Minimum 628 lb per cubic yard.
 - 4. Water-Cement Ratio: Maximum 0.462 by weight.

5. Total Air Content: 6 percent plus or minus 1 percent, per ASTM C 173.
6. Slump: 6 inches plus or minus 1 inch.
7. Maximum Aggregate Size: 1/2 inch.

2.9 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

1. Delivery Tickets:

- a. A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to the Contractor by the truck operator at the time of delivery before unloading at the site.
- b. Copies of delivery tickets shall be given to the Engineer upon request.
- c. Tickets shall indicate the following:
 - 1) Name and location of the concrete supplier.
 - 2) Serial number of ticket.
 - 3) Date.
 - 4) Truck number.
 - 5) Name of purchaser.
 - 6) Project name and location.
 - 7) Numerical sequence of the delivery.
 - 8) Specific class or designation of the concrete.
 - 9) Amount of concrete in cubic yards.
 - 10) Time loaded or of first mixing of cement and aggregates.
 - 11) Reading of revolution counter at the first addition of water.
 - 12) Type and brand and amount of cement.
 - 13) Type and brand and amount of admixtures.
 - 14) Information necessary to calculate the total mixing water added by the producer. Total mixing water includes free water on the aggregates, water, and ice batched at the plant.

- 15) Maximum size of aggregate.
 - 16) Weights of fine and coarse aggregate.
 - 17) Outdoor temperature in the shade at the time at which the cement was added.
 - 18) Signature or initials of ready-mix representative.
2. Water from the truck water system or elsewhere shall not be added after the initial introduction of mixing water for the batch.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- E. In locations where new concrete is doweled to existing work, drill holes and epoxy dowels in existing concrete.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 318.
- B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
- D. For all items subject to corrosion, including tie wires, provide the same concrete cover as is required for reinforcement under the same condition.

3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Concrete placed by pumping methods shall be done in accordance with ACI 304.2R.
- D. Mixing Time: The time from initial introduction of mixing water to discharge shall not exceed the following computation: Time = 1 hour at concrete temperature of 75 degrees F +/- 15 minutes per 5 degree F drop/rise in concrete temperature. Examples follow:
 - 1. At concrete temperature of 50 degrees F, the time to discharge shall not exceed 2 hours and 15 minutes.
 - 2. At concrete temperature of 60 degrees F, the time to discharge shall not exceed 1 hours and 45 minutes.
 - 3. At concrete temperature of 70 degrees F, the time to discharge shall not exceed 1 hours and 15 minutes.
 - 4. At concrete temperature of 80 degrees F, the time to discharge shall not exceed 45 minutes.
- E. Notify Engineer not less than 24 hours prior to commencement of placement operations.
- F. Before concrete is placed, forms, reinforcement, waterstops, anchor bolts, and embedments shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements shall be cleaned.
- G. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- H. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.5 SLAB JOINTING

- A. Locate joints as indicated on the 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. Prior to concrete placement, the subgrade shall be well-dampened.
- E. All exterior walls and interior floor slabs shall be in place and shall have obtained the design compressive strength prior to backfilling.
- F. Conveying Concrete:
 - 1. Methods of conveying concrete to the point of final deposit shall prevent segregation or loss of ingredients.
 - 2. The free drop of concrete shall be limited to 5 feet.
 - 3. Drop chutes shall be used for placement of concrete in walls. Drop chutes shall be positioned in walls 5 feet or less from wall corners and at 10 feet maximum centers.
 - 4. After placement in the forms, concrete shall not be moved laterally more than 5 feet.
- G. Consolidation/Compaction:
 - 1. Consolidate in accordance with ACI 309R.
 - 2. For proper consolidation/compaction, concrete shall be placed in approximately horizontal layers not to exceed 24 inches. Each layer of concrete shall be plastic when covered with the following layer, and the rate of vertical rise of the concrete in the forms shall be not less than 24 inches per hour.
 - 3. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms.
 - 4. The number and type of vibrators shall be acceptable to the Engineer.
 - 5. When using internal vibrators, the "field of action" shall overlap. When placing concrete in lifts, the vibrator shall penetrate the previous lift by a few inches.
 - 6. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.
- H. Placement of Concrete on Slopes: Place, consolidate, and finish concrete from the bottom of the slope to the top of the slope.
- I. Separate slabs on grade from vertical structure surfaces with joint filler.

- J. Place joint filler in floor slab pattern placement sequence where indicated. Set top to required elevations. Secure to resist movement by wet concrete.
- K. Install joint devices in accordance with manufacturer's instructions.
- L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- M. Place concrete continuously between predetermined expansion, control, and construction joints.
- N. Do not interrupt successive placement; do not permit cold joints to occur.
- O. Place floor slabs in checkerboard or saw cut pattern indicated.
- P. Saw cut joints within 12 hours after placing. Unless noted otherwise, use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- Q. Screed floors and slabs on grade to slope as indicated, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.6 Tolerances:

- A. As specified in ACI 301 unless noted otherwise.
- B. All concrete areas shall slope to drain. Water shall not be allowed to pond at any location.

3.7 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
 - 1. Tie holes in formed surfaces shall be cleaned, wetted, and filled with non-shrink grout.
 - 2. The patches shall be finished flush and shall match the texture of the adjacent concrete.
- B. Unexposed form finish including pit interiors: Rub down or chip off fins or other raised areas 1/8 inch or more in height.
- C. Exposed form finish including, but not necessary limited to, walls, foundations & footings above grade, and retaining walls: Rub down or chip off and smooth all fins, offsets, or other raised areas 1/8 inch or more in height. Provide finish as follows:
 - 1. Grout Cleaned Finish: Grout cleaned finish shall conform to Paragraph 5.3.3.4.b of ACI 301. Grout cleaning shall not result in an overall plastering of the

concrete surface, but shall produce a smooth, uniform surface free of marks, voids, surface glaze, and cement dust.

- a. Sandblast surface to expose air voids, sand aggregate, and to remove all form marking. Abrasive blast to scarify bare concrete to an ICRI CSP 5 surface profile and no more than an ICRI CSP 6 profile. Sandblast material shall be No. 4 Flint rock particles or "Black Beauty" or "Black Magic" (a boiler/coal slag).
- b. Mix 1 part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
- c. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun.
- d. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
- e. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, burlap, or other means.
- f. After the surface whitens from drying (about thirty minutes at normal temperatures), rub vigorously with clean burlap to provide a uniform sandy textured surface. For lazy river walls, the top 18 inches of the wall shall be rubbed sufficiently to provide a relatively smooth surface.
- g. The finish shall be kept damp for at least 36 hours after final rubbing.

D. Finishing Unformed Surfaces:

1. General:
 - a. Buried concrete blocking and encasement will require no finishing except as necessary to obtain the required surface elevations or contours.
 - b. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating, and troweling where required.
 - c. Water shall not be applied to the concrete during finishing operations.
2. Screeding: Screeding shall produce a concrete surface conforming to the proper elevation and contour, with all aggregates completely embedded in mortar.
3. Floating:
 - a. Bull Floating: Screeded surfaces shall be given an initial float finish immediately following screeding and shall be completed before any excess moisture or bleeding water is present on the surface. Any piece

of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

- b. Initial floating shall be followed by a second floating at the time of initial set (when foot pressure will mark concrete to about 1/4 inch depth). Do no floating with bleed water present. If conditions permit, wait out the bleeding period before floating. If not, remove bleed water before starting floating operations per ACI 302.1R. The second floating shall produce a finish of uniform texture and color.
- c. Floating shall be done with hand floats or suitable mechanical compactor-floats.

4. Finishing: Finish to requirements of ACI 302.1R, and as follows:

- a. Surge Tanks or Wet Pits: Light broom finish. Brooming shall be done after the second floating.
- b. Pump Pits: Broom finish to provide a uniform medium non-slip surface. Brooming shall be done after the second floating.
- c. Concrete Decks and Walks: Broom finish to provide a uniform medium non-slip surface. Brooming shall be done after the second floating and at right angles to the normal direction of traffic.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.8 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. 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 7 days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven days by water ponding, water-saturated sand, water-fog spray, saturated burlap, or low permeability and high moisture retention non-staining natural cellulose fabric with non-perforated reflective (white) polyethylene coating.

2. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.
- E. Concrete shall be protected against freezing for at least 8 days after placement.

3.9 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. All concrete required for testing shall be furnished by, and at the expense of, the Contractor.
- D. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of concrete operations.
- E. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- F. When concrete is pumped, sampling at both the truck discharge and point of final placement shall be required to determine if any changes in the slump, air content, and other significant mix characteristics occur. All concrete characteristics at the point of placement shall meet the specified requirements.
- G. Compressive Strength Tests:
 1. Compression test specimens shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C 31 and C 39.
 2. One set of concrete test cylinders shall be cast for each concrete pour unless approved otherwise by Engineer. A set of test cylinders shall consist of four cylinders, two to be broken and to have compressive strengths averaged at 7 days, and two to be broken and to have compressive strengths averaged at 28 days.
 3. One additional test cylinder shall be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
 4. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, and the concrete temperature.
- H. Air Content:

1. Air content shall be determined in accordance with ASTM C 231.
2. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made.
3. The Contractor shall provide all equipment and supplies necessary for the testing.

I. Slump:

1. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
2. Pumped Concrete:
 - a. The slump of concrete that is discharged into the pump may exceed the specified value by the amount of slump loss in the pumping system, up to a maximum of 1 inch.
 - b. The slump loss shall be determined by tests made at each end of the pumping system.
 - c. If tests indicate a loss greater than 1 inch, Contractor shall modify the pumping system as required to reduce the slump loss to 1 inch or less.

J. Concrete Temperature:

1. A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made.
2. Concrete temperature shall be determined in accordance with ASTM C 1064.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. In water retaining structures, crack widths that exceed ACI 224R requirements of 0.004 inches shall be treated with an appropriate injection system, which is acceptable to the Engineer.
- D. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

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

END OF SPEC SECTION 131115

SECTION 131185 - EQUIPMENT FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pumps.
- B. Chemical feeders.
- C. Ultraviolet light (Alternate No. 1)
- D. Flow measuring devices.
- E. Electronic water level sensor.

1.2 RELATED SECTIONS

- A. Section 13 11 90 - Piping and Valves For Spray Grounds

1.3 REFERENCES

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Pumps and Motors: The data and specifications for each unit shall include, but shall not be limited to, the following:
 - 1. Pumps:
 - a. Name of manufacturer.
 - b. Type and model.
 - c. Rotative speed.
 - d. Size of suction nozzle.
 - e. Size of discharge nozzle.
 - f. Net weight of pump.
 - g. Complete performance curves showing capacity versus head, NPSH required, pump efficiency, and BHP.

2. Motors:
 - a. Name of manufacturer.
 - b. Type and model.
 - c. Type of bearing and lubrication.
 - d. Rated size of motor, HP.
 - e. Temperature rating.
 - f. Full load rotative speed.
 - g. Net weight.
 - h. Efficiency at full, 3/4, and 1/2 load.
 - i. Full load current.
 - j. Locked rotor current.

- C. Product Data: Manufacturer's catalog data, detail sheets, and specifications.
- D. Shop Drawings: Prepared specifically for this project; show dimensions of equipment and interface with other products.
- E. Manufacturer's Instructions: Indicate installation methods and procedures.
- F. Operating and Maintenance Data: Operating and maintenance instructions, parts lists, and wiring diagrams.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Perform in accordance with applicable codes and health department regulations , as required for location of project.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.
- C. Supplier's Field Representative: Individual specializing in the start-up and training of the equipment specified in this section, with not less than 5 years experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

- E. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver materials and equipment to project site in manufacturer's original packaging..
- B. Store all materials and equipment under cover and elevated above grade or as instructed by manufacturer.

PART 2 PRODUCTS

2.1 SUPPLIERS

- A. Swimming Pool Supply Company, 5292 N.W. 111th Street Drive, Grimes, Iowa 50111. Tel: (515) 986-3931; Fax: (515) 986-3805.
- B. United Industries, Inc., 202 E. Cleveland, PO Box 58, Sterling, Kansas 67579. Tel: (800) 835 3272; Fax: (800) 500-3115; www.swimtime.com.
- C. Spectrum Pool Products, 7100 Spectrum Lane, Missoula, Montana 59808. Tel: (800) 776-5309; Fax: (800) 728-7143; www.spectrumproducts.com.
- D. Recreation Supply Company, P.O. Box 2757, Bismarck, ND 58502. Tel: (800) 437-8072; Fax: (701) 255-7895; www.recsupply.com.

2.2 END SUCTION CENTRIFUGAL PUMPS (SMALL PUMPS)

- A. Specified Manufacturer: Speck Pumps, Jacksonville, FL, Tel: (800) 223-8538 www.Speck-Pumps.com
- B. Acceptable manufacturers:
 - 1. Pentair Pools, Integral strainer pump: Tel: (800) 831-7133, www.pentairpool.com
 - 2. Hayward: www.Hayward.com
- C. Pump Schedule:
 - 1. Recirc pump: Model Pro Series 56 Frame, Badu Pro-III
 - 2. Features pump: Model 95-IX
- D. Pumps shall be high performance end suction pump meeting the following:

1. Housing: Thermoplastic
 2. Shaft: Stainless Steel
 3. Performance Criteria: As indicated on the drawings
 4. Pumps shall be NSF-50 certified
- E. Motor:
1. Size and Speed: As indicated on drawings
 2. Voltage/Phase: As indicated on the drawings.
 3. VFD: As indicated on the drawings.
- F. General:
1. Self-priming
 2. Pump shall be able to be connected to water feature controller.
 3. IntelliFlo and IntelliPro pumps shall be provided with Intellicom system when required to be connected to remote Start-Stop-Timers.

2.3 SUMP PUMP

- A. Grainger Stock No. 3YU59.
- B. Acceptable manufacturers:
1. Zoeller: www.ZoellerPumps.com
 2. Goulds: www.GouldsPumps.com
- C. Specifications:
1. Submersible plastic sump pump.
 2. HP Rating: 1/2.
 3. Voltage: 115.
 4. Automatic switch with off point 1.38 inches and on point at 5.9 inches.
 5. Water flow at 5 feet of head: 41 gpm.
 6. Shut-Off: 35 feet.

7. Discharge NPT: 1-1/4 inches.
8. Maximum Solid Handling: 1/8 inch.
9. Maximum Temperature: 77 degrees F.
10. Cord: 18/3 x 10 feet.

2.4 FIBERGLASS PRESSURE SAND FILTERS

- A. Specified Manufacturer: Pentair; Model Triton II; www.pentair.com.
- B. Acceptable Manufacturers:
 1. Waterco; Model SM; www.waterco.us
 2. Hayward: www.Hayward.com
- C. Construction: Durable, non-corrosive filter with 3" connections.
- D. Certifications: Filter shall be tested and certified by a nationally recognized testing laboratory to conform to NSF Standard 50.
- E. Multiport valve.
- F. Filter Area: Per the drawings.
- G. Sand/Gravel Media:
 1. Quantity: Sand and gravel per manufacturer to meet NSF Standard 50.
 2. Filter Sand:
 - a. No. #20 white quartz silica sand.
 - b. Size Range: 0.40 to 0.55 mm.

2.5 CHEMICAL FEEDERS - PERISTALTIC TYPE

- A. Manufacturers:
 1. Specified Manufacturer: Stenner & Company, Inc.; Tel: (800) 683-2378 or (904) 641-1666; Fax: (904) 642-1012; www.stenner.com.
 2. Acceptable Manufacturers:
 - a. Blue-White; Tel: (714) 893-8529; Fax: (714) 894-9492; www.bluwhite.com

- b. LMI: www.LMIPumps.com
- B. General: Chemical feed pumps shall be peristaltic type pumps that are UL approved.
- C. Voltage: 120 VAC, US Plug.
- D. Accessories:
 - 1. Corrosion resistant mounting hardware and accessories including corrosion resistant mounting bracket and rain roof.
 - 2. Provide complete suction assembly including lead tubing, connecting nut, ferrule, and clay weight.
 - 3. Provide complete discharge assembly including lead tubing, connecting nuts, and injection fitting.
 - 4. Provide five (5) tube assemblies with ends.
- E. Schedule:
 - 1. Spray ground - Muriatic Acid Feeder: Model 45M5; 50.0 gpd; 25 psi.
 - 2. Spray ground - Sodium Hypochlorite Feeder: Model 45M1; 3.0 gpd; 25 psi.

2.6 ULTRAVIOLET LIGHT (LOW PRESSURE, HIGH OUTPUT) - (Alternate No. 1)

- A. Specified Manufacturer: Sentry Ultraviolet, Inc.; Model SAG 240-A-PVC-CR; Tel: (866) 226-0820 or (706) 379-2670; Fax: (706) 379-1428; www.sentryuv.com.
- B. Acceptable manufacturers:
 - 1. Pentair BioShield Pro
 - 2. Delta UV, Evoqua
- C. Lamps:
 - 1. Type: Low pressure, high output (amalgam).
 - 2. Maximum Lamp Power: 120 watts.
 - 3. Number of Lamps: 2.
 - 4. Lamp Life: 13,000 hours.
- D. UV Dose (to be verified per Local Code and mfr.):
 - 1. Spray Grounds

- a. Design dose: 60 mJ/cm²
 - b. End of lamp life dose: 45 mJ/cm²
- E. Chamber:
 - 1. Provide quick disconnects at each sleeve.
 - 2. Maximum Operating Pressure: 50 psi.
 - 3. Connection: Stainless steel flanges.
 - 4. Chamber Material: Sch 80 PVC with 316L stainless steel interior.
 - 5. Provide a drain plug that allows draining the unit for winterization.
 - 6. Provide with a safety cover that when removed turns all lamps off before they can be removed.
- F. Control Panel:
 - 1. Power: 120 or 240 volt, as indicated on the electrical drawings.
 - 2. Safety Features:
 - a. Terminally protected automatically shuts down if abnormal operating temperature are reached.
 - b. A pressure switch shall shut the system off if the water flow stops.
 - c. Sensor monitors fouling and loss of 254nm sterilizing wave length. LED lights on control alerts of this condition.
 - d. Sensor detect lamp outage. Glow fitting on top of lamp will alert of lamp outage.
 - 3. Switch: Lighted on/off switch showing whether power is on or off.
- G. Strainer: Provide a strainer for installation downstream of unit to capture broken glass.

2.7 SECONDARY CONTAINMENT PALLET AND RAMP

- A. Pallet:
 - 1. Description: Low profile drum spill containment pallet constructed of low-density polyethylene for excellent durability and chemical resistance. Features textured grating which removes easily for cleaning. Translucent sidewalls allow easy visual inspection.

2. Capacity: 22 gallons.
3. Load Capacity: 3,000 lbs.
4. Dimensions: 26" W x 52" L x 5.75" H.

B. Ramp:

1. Load Capacity: 600 lbs.
2. Dimensions: 33.5" W x 24" L x 5.75" H.
3. Composition: Polyethylene.

2.8 FLOW MEASURING DEVICES

A. Indicator Arm Flowmeter:

1. Specified Manufacturer: H2flow Controls, Inc.; Model FlowVis Flowmeter; www.h2flow.net.
2. Acceptable manufacturers:
 - a. Blue-White Industries: www.Blue-White.com
 - b. Signet: www.gfps.com
3. Features:
 - a. Direct reading in gallons per minute (gpm).
 - b. NSF 50 Approved.

2.9 ELECTRONIC WATER LEVEL SENSOR

A. The system shall be complete with the following:

1. Sensor with wire and remote sensor housing.
2. Control box.
3. 24 VAC solenoid valve.

B. The system shall be solid state, with non-corrosive components, NEMA 4 enclosure and all components suitable for use in a mechanical room environment.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate with other trades for proper installation of plumbing and electrical services.
- B. Verify that required utilities are in correct location and are of correct capacities for specified products.
- C. Verify equipment rough-in before proceeding with work.

3.2 INSTALLATION

- A. Install equipment specified in this section in accordance with manufacturer's printed installation instructions; comply with standards required by authorities having jurisdiction.
- B. Schedule installation to ensure that utility connections are achieved in an orderly and expeditious manner.
- C. Install equipment plumb, level, square, and straight, without distortion; securely anchor.

3.3 STARTING EQUIPMENT AND SYSTEMS

- A. Adjust for proper operation within manufacturer's published tolerances.
- B. Provide supplier's field representative to prepare, start, adjust, and demonstrate proper operation of equipment to Owner's designated staff.

3.4 CLEANING

- A. Touch up minor damaged surfaces caused by installation.
- B. Replace damaged components as directed by Engineer.
- C. Clean all equipment.
- D. Protect installed equipment from subsequent construction operations.

END OF SPEC SECTION 131185

SECTION 131187 - CHEMICAL CONTROLLER FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. A programmable chemical automation system for continuous monitoring and control of pH and disinfectant.

1.2 RELATED SECTIONS

- A. Section 13 11 85 - Equipment for spray grounds

1.3 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for specified systems, including all components.
- C. Shop Drawings: Indicate component connection details and details of interface with adjacent construction.
- D. Manufacturer's Instructions: Indicate installation instructions for specified equipment, including each component.
- E. Operation and Maintenance Data: The manufacturer shall supply a complete instruction, operating and maintenance manual.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.
- C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Delivery: Deliver materials to site in manufacturer's original, unopened packaging.
- B. Storage: Store all equipment and materials under cover and elevated above grade.
- C. Protection: Protect equipment and materials to prevent damage.

1.6 WARRANTY

- A. The controller shall be covered by a standard manufacturer warranty of five (5) years.
- B. All sensors will be covered by a standard one (1) year warranty.
- C. Other parts shall be covered by their own manufacturer's warranty.
- D. The controller shall not require a service technician for annual calibration, seasonal start up, or whenever chemicals supplier or type are changed.

PART 2 PRODUCTS

2.1 CONTROLLER

- A. Manufacturers:
 - 1. Specified Manufacturer: Santa Barbara Control Systems; Model Chemtrol PC2100 Programmable Controller: 5375 Overpass Road, Santa Barbara, CA 93111; Tel: (800) 621-2279; Fax: (805) 683-1893; www.sbcontrol.com.
 - 2. Acceptable manufacturers:
 - a. BECS
 - b. ProMinent
- B. The controller shall automatically activate the appropriate chemical feeders in order to maintain the sanitizer activity level within +/- 10 mV (millivolts) of ORP and the pH within +/- 0.1 pH unit of the setpoints selected by the operator. All setpoint and calibration levels shall be adjustable with a numeric keypad mounted on the front panel of the unit. Controllers with internal switches or calibration adjustments and/or requiring special signal generating equipment to service will not be considered equal.
- C. The controller shall include programmable daily and weekly cycles for shocking (superchlorination) and chemical saving level.

- D. The controller shall continuously display the Langelier Saturation Index using either sensor data and/or manual input for pH, temperature, total alkalinity and calcium hardness. The resulting calculated water condition shall be displayed on the main screen as either "Scaling", "Corrosive" or "OK".
- E. The controller shall be contained in a NEMA Type 3 (rain and splash proof) lockable fiberglass cabinet with an LCD graphic display screen of four (4) lines of twenty (20) alphanumeric characters each. The main display screen shall show the current values, control mode and operational status for ORP, pH and temperature. Controllers with smaller displays or displays that require scrolling through menus will not be considered equal. All screens shall have the capability of being displayed at any time at the option of the operator in unabbreviated English, French or Spanish and in US or metric units.
- F. The controller shall be factory set to water treatment industry standards. The operator shall be able at any time to adjust all programmable functions to preferred settings. The controller shall have a reset mode to reset all or selected functions to the original factory standards.
- G. The controller shall have the capability to calibrate all sensor inputs, depending on the accuracy needed, using either 1, 2, or 3-point calibration to determine respectively the origin, slope and curvature of the calibration curve.
- H. The controller shall be capable of operating each output in the following operator-selectable modes of operation: automatic, manual, timer or off. In the automatic mode, the operator shall be able to choose between on/off control and proportional feed control based on deviation from setpoint.
- I. The controller shall include programmable high and low alarm levels for all control functions with operator selectable feed lockout and alarm buzzer options.
- J. The controller shall continuously monitor and alert for probe failure using dynamic probe testing before the water chemistry gets out of range. Failure alarms based only on safety timers and/or out-of-range conditions will not be considered equal.
- K. The controller shall record and display the elapsed run time for each activation event and a cumulative run time resettable at any time by the operator. The controller shall provide for operator-adjustable run time limits for all control functions.
- L. The controller shall include a battery for memory storage with minimum reserve power for six (6) months of power shutdown.
- M. The controller shall have an on-board memory for storing of test data on operator-selectable schedules. An RS-232 serial communications port shall be included for on-site downloading of test data.
- N. Options to be provided:
 - 1. ETHCOM: The controller shall include an Ethernet/Internet modem for remote operation by PC-compatible computer using Ethernet/Internet network

communications. A Windows-based software program shall be supplied with true duplex operation capability representing the actual controller screen display with automatic downloading and visual graphics representation of test data.

2. Water Temperature: The controller shall monitor and display the water temperature in degrees Fahrenheit or Celsius with adjustable high and low alarms.
3. BPL: A bypass line for installation of the sensors shall be provided with a safety flow switch and a sampling valve for water testing. An in-line filter and flowmeter shall be provided as required by mfr.
4. SCA: The sensors shall be mounted in a see-through flow cell with a clear cover located inside a lockable fiberglass enclosure with a window.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install all equipment in accordance with shop drawings and manufacturer's printed installation instructions; comply with standards required by authorities having jurisdiction.
- C. Schedule installation to ensure that utility connections are achieved in an orderly and expeditious manner.
- D. Install equipment plumb, square, and straight, without distortion; securely anchor.

3.2 INTERFACE WITH OTHER WORK

- A. Coordinate with other trades for proper installation of plumbing.

3.3 STARTING EQUIPMENT AND SYSTEMS

- A. Adjust for proper operation within manufacturer's published tolerances.
- B. Provide manufacturer's field representative to check-out installation, provide start up, and instruct operating personnel on proper operation and maintenance of equipment.

3.4 ADJUSTING AND CLEANING

- A. Adjust equipment, including water requirements, for smooth operation.
- B. Touch up minor damaged surfaces caused by installation.

C. Replace damaged components as directed by Engineer.

3.5 CLEANING and PROTECTION

A. Clean all pieces of equipment.

B. Protect installed equipment from subsequent construction operations.

END OF SPEC SECTION 131187

SECTION 131190 - PIPING AND VALVES FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
- B. Polyvinyl chloride (PVC) pipe.
- C. Saddles.
- D. Valve keys.
- E. Valve extension stems and stem guides.
- F. Valve boxes.
- G. Valves.
- H. Strainers.
- I. Pressure gauges.
- J. Compound pressure gauges.

1.2 RELATED REQUIREMENTS

- A. Section 13 11 94 - Mechanical Identification for spray grounds

1.3 REFERENCE STANDARDS

- A. ASME B16.5 - Pipe Flanges and Flanged Fittings; 1996.
- B. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).
- C. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
- D. ASTM D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 1999a.
- E. ASTM D 2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 1999.

- F. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- G. ASTM F 656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings; 1996a.
- H. ASTM F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2001.
- I. ASTM F 594 - Standard Specification for Stainless Steel Nuts; 2001.
- J. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data/ Submittals:
 - 1. Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - 2. For PVC piping, provide manufacturer's recommended installation procedures, including solvent weld jointing procedures.
- C. Project Record Documents: Record actual locations of piping and valves.
- D. Training and certification documentation as indicated below.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Training and Certification: PVC Pipe Installer.
 - 1. PVC piping installers must be trained by manufacturer to install and join piping. Submit written certification from manufacturer for each individual performing pipe installation, prior to installing pipe.
- C. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with local plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

- A. PVC Pipe, Schedule 80:
 - 1. Pipe: ASTM D 1785, Cell Classification 12454-B, bearing NSF seal.
 - 2. Fittings: ASTM D 2467, Cell Classification 12454-B, bearing NSF seal.
 - a. All fittings for pipe diameters less than 16" shall be molded. Fabricated fittings will not be allowed unless approved by Engineer. Contractor shall be responsible for verifying that the use of fabricated fittings will not affect critical dimensional requirements.
 - b. For pipe diameters of 16" or greater: Fabricated fitting are allowed.
 - 3. Push-on Joints: ASTM F 477 elastomeric gaskets.
 - 4. Solvent Weld Joints:

- a. Solvent Cement: ASTM D 2564.
 - b. Primer: ASTM F 656.
 - 5. Flanges: Diameter and drilling shall conform to ANSI/ASME B16.5, Class 150.
 - 6. Flange Hardware:
 - a. Bolts: Stainless steel, ASTM F 593, Alloy Group 1 or 2; chamfered or rounded ends projecting 1/8 to 3/8 inch beyond outer face of nut.
 - b. Nuts: Stainless steel, ASTM F 594, Alloy Group 1 or 2.
 - c. Flat Washers: Stainless steel, ANSI B18.22.1.
 - 7. Flange Gaskets: Full face, 1/8 inch thick, chemical resistant elastomeric material suitable for the specified service.
- B. PVC Pipe, Schedule 40:
- 1. Pipe: ASTM D 1785, Cell Classification 12454-B, bearing NSF seal.
 - 2. Fittings: ASTM D 2466, PVC. All fittings for pipe diameters of less than 16" shall be molded. Fabricated fittings will not be allowed unless approved by Engineer. Contractor shall be responsible for verifying that the use of fabricated fittings will not affect critical dimensional requirements. For pipe diameters of 16" or greater: Fabricated fitting are allowed.
 - 3. Push-on Joints: ASTM F 477 elastomeric gaskets.
 - 4. Solvent Weld Joints:
 - a. Solvent Cement: ASTM D 2564.
 - b. Primer: ASTM F 656.
- C. PVC Pressure-Rated Pipe, SDR 21:
- 1. Pipe: ASTM D 2241 SDR 21 for 200 psi rating.
 - 2. Fittings: ASTM D 2466, PVC.
 - 3. Joints: ASTM D 2855, solvent weld.

2.2 ADAPTER FLANGE FOR PVC PIPE

- A. Van Stone Style:
 - 1. Two-piece design with rotating flange ring in socket or spigot configuration.

2. Conformance Standards:

- a. Socket and Spigot: ASTM D 2467.
- b. Bolt Hole Pattern: ASME B16.5.
- c. Material: ASTM D 1784; PVC Cell Classification 12454-B.

2.3 SPECIAL REINFORCED FITTINGS

- A. All threaded plastic connections and threaded plastic-to-metal transition connections shall be made with Spears Special Reinforced (SR) Fittings.
- B. All fittings shall be Schedule 80 PVC, conforming to ASTM D 2467.
- C. All fittings shall be approved for potable water service.

2.4 FLANGES, UNIONS, AND COUPLINGS

- A. A union or a flanged connection shall be provided within 2 feet of each threaded end valve unless the valve can be easily removed from the piping.
- B. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- C. Flanges for Pipe Size Over 1 Inch:
 - 1. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- D. Dielectric Fittings:
 - 1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
 - 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 - 3. Dielectric Unions:
 - a. Manufacturers:
 - 1) Capitol Manufacturing Co.
 - 2) Central Plastics Company.
 - 3) Eclipse, Inc.

- 4) Epco Sales, Inc.
 - 5) Hart Industries, International, Inc.
 - 6) Watts Industries, Inc.; Water Products Div.
 - 7) Zurn Industries, Inc.; Wilkins Div.
- b. Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 degrees F.
4. Dielectric Flanges:
- a. Manufacturers:
 - 1) Capitol Manufacturing Co.
 - 2) Central Plastics Company.
 - 3) Epco Sales, Inc.
 - 4) Watts Industries, Inc.; Water Products Div.
 - b. Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits:
- a. Manufacturers:
 - 1) Advance Products & Systems, Inc.
 - 2) Calpico, Inc.
 - 3) Central Plastics Company.
 - 4) Pipeline Seal and Insulator, Inc.
 - b. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - c. Separate companion flanges and steel bolts and nuts shall have 150-psig minimum working pressure where required to suit system pressures.
6. Dielectric Couplings:
- a. Manufacturers:
 - 1) Calpico, Inc.

- 2) Lochinvar Corp.
- b. Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
- 7. Dielectric Nipples:
 - a. Manufacturers:
 - 1) Perfection Corp.
 - 2) Precision Plumbing Products, Inc.
 - 3) Sioux Chief Manufacturing Co., Inc.
 - 4) Victaulic Co. of America.
 - b. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.

2.5 PVC SADDLES

- A. All plastic saddle fittings shall be clamp-on type with O-ring seal constructed from PVC Schedule 80.
- B. All O-rings shall be EPDM.
- C. All saddles shall be piloted at O-ring area for positive positioning in pipe.
- D. All bolt clamping hardware shall be stainless steel.
- E. All threaded saddle outlets shall be Steel Reinforced (SR) design.
- F. Saddles shall have a maximum internal pressure rating of 235 psi for pipe sizes through 4 inch, 200 psi for 6 inch pipe, and 150 psi for 8 through 12 inch pipe at 73 degrees F.

2.6 VALVE KEY

- A. Material: Rolled steel.
- B. The valve key shall be made up of an extension rod, a wrench nut at the bottom, and at the top a "T" handle.
- C. The wrench nut shall fit over the 2 inch square nut of the valve stem being raised.

- D. Length: The length of the valve key shall be as required to operate the valve(s) at a height of 3 feet above grade (operating level).

2.7 VALVE EXTENSION STEMS AND STEM GUIDES

A. Manufacturers:

1. Specified Manufacturer: Trumbull Industries, Inc.; Tel: (800) 677-1799; www.trumbull.com.
2. Acceptable Manufacturers:
 - a. M & H; Tel: (256) 237-3521; www.mh-valve.com.
 - b. Clow; Tel: (800) 829-2569; www.clowvalve.com.
 - c. Waterman Industries, Inc.; Tel: (800) 331-0808; www.watermanusa.com.

B. Extension Stems:

1. Material: Type 304 stainless steel.
2. The extension stem shall be made up of an extension rod, a wrench nut coupling at the bottom, and at the top a 2 inch square wrench nut or handwheel as indicated on the drawings.
3. The wrench nut coupling shall fit over the 2 inch square nut of the valve stem being raised and shall be held to the nut by a set screw threaded in the wrench nut coupling.
4. The wrench nut or handwheel and wrench nut coupling shall be pinned to the extension rod which is drilled to receive steel pins.
5. The wrench nut and wrench nut couplings shall be stainless steel, Type 316.

C. Stem Guides:

1. Stem guides shall be installed as wall brackets to support extension stems.
2. Valve stem guides shall be fully adjustable and made of Type 316 stainless steel.
3. The guide shall be bronze bushed where the extension stem passes through.

2.8 VALVE BOXES - PLASTIC

- A. Specified Manufacturer: Rainbird; www.rainbird.com.

- B. Acceptable manufacturers:
 - 1. Hubbell: www.Hubbell.com
 - 2. NDS: www.NDSPro.com
- C. Rugged, UV-resistant thermoplastic construction.
- D. Slotted body to facilitate installation of piping.
- E. Light traffic rated

2.9 PVC BALL VALVES

- A. Manufacturers:
 - 1. Spears Manufacturing Company: www.spearsmfg.com.
 - 2. Nibco, Inc; Model U-45TB: www.nibco.com.
 - 3. Hayward Industries, Inc.: www.haywardflowcontrol.com.
- B. Construction:
 - 1. True Union type constructed from PVC Type I Cell Classification 12454 conforming to ASTM D 1784.
 - 2. O-rings shall be EPDM.
 - 3. All valves shall have Safe-T-Shear stem and double stop polypropylene handle.
 - 4. All valve union nuts shall have Buttress threads.
 - 5. All valve seal carriers shall be Certified for potable water use by NSF International.
 - 6. All 1/2 inch through 2 inch valves shall be pressure rated at 235 psi and all 2-1/2 inch through 6 inch valves shall be pressure rated at 150 psi for water at 73 degrees F.

2.10 PVC BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Specified Manufacturer: Spears Manufacturing Company; Style Wafer or Lug: www.spearsmfg.com.
 - 2. Acceptable Manufacturers:

- a. ASAHI/AMERICA: www.asahi-america.com.
- b. Hayward Industries, Inc.: www.haywardflowcontrol.com.
- c. Nibco, Inc: www.nibco.com.

B. Construction:

- 1. Valve body and disc shall be constructed from PVC Type I Cell Classification 12454 conforming to ASTM D 1784.
- 2. Valve seats and O-rings shall be EPDM. Seat shall be a non-liner type interlocked to valve body.
- 3. Lug Style: Bolt hole patterns shall conform to ANSI/ASME B16.5 CL 150.
- 4. Wafer Style: Designed for mounting between two flanges having bolt hole pattern that conform to ANSI/ASME B16.5 CL 150.
- 5. Disc shall be offset design with Type 316 stainless steel stem.
- 6. Lever operated valves shall be equipped with high impact polypropylene handle having built-in lockout capability.
- 7. Gear operated valves shall be equipped with position indicator and high impact polypropylene handwheel.
- 8. All submerged valves shall have submersible gear operators.
- 9. Valves shall be pressure rated at 150 psi for water at 73 degrees F.

2.11 BRASS SOLENOID VALVES

A. 3/4 to 2 Inch:

- 1. Specified Manufacturer: Granzow; Model 21W; www.granzow.com.
- 2. Acceptable manufacturer:
 - a. ASCO: www.AscoValve.com
 - b. US Solid: www.USSolid.com
- 3. Description: Two-way, internally piloted, normally closed or normally open (as indicated on the drawings), solenoid valve.
- 4. Sealing Material: FKM (Viton).
- 5. Pipe Size: As indicated on the drawings.

6. Materials of Construction:
 - a. Body: Brass.
 - b. Armature Tube: Stainless Steel 300.
 - c. Fixed Core: Stainless Steel 400.
 - d. Plunger: Stainless Steel 400.
 - e. Spring: Stainless Steel 300.
 - f. Shading Ring: Copper.
 - g. Orifice: Brass.
7. Provide with nickel plated finish.
8. Coil Specifications:
 - a. BDU Molding Material: PET - Black polyester - Class F (312 degrees F).
 - b. Power/Voltage: 8 watt/110-120 volt or 8 watt/24 volt as indicated on the drawings.
9. Electrical Connection:
 - a. Rating: NEMA 4.
 - b. Provide with 1/2" conduit connector.

2.12 PVC BALL CHECK VALVES

- A. Application: For use on PVC piping systems where called for on the drawings; sizes 6" and smaller.
- B. Construction:
 1. Constructed from PVC Type I Cell Classification 12454 conforming to ASTM D 1784.
 2. Industrial grade.
 3. All valve seals shall be standard O-ring type EPDM.
 4. Fully serviceable with replaceable components.

5. Sizes 1/2 inch to 2 inch shall be pressure rated to 235 psi, sizes 2-1/2 inches to 6 inches and all flanged shall be pressure rated to 150 psi for water at 73 degrees F.
6. NSF certified for potable water use.

2.13 PVC INDUSTRIAL SWING CHECK VALVES

- A. Application: For use on PVC piping systems; sizes 8" and smaller.
- B. Construction:
 1. Flanged swing check type constructed from PVC Type I Cell Classification 12454 conforming to ASTM D 1784.
 2. All valve seals shall be standard O-ring type EPDM.
 3. All valve components shall be replaceable.
 4. All valves shall have O-ring sealed drain plug.
 5. All valves shall have external counter balance.
 6. All 3/4 inch to 4 inch valves shall be pressure rated at 150 psi, all 6 inch valves at 100 psi, and all 8 inch valves at 70 psi for water at 73 degrees F.

2.14 AIR RELEASE VALVES

- A. Specified Manufacturer: A.R.I. USA, Inc.; Model S-050 V: Tel: (559) 269-9653; www.ariususa.com.
- B. Acceptable manufacturers:
 1. Flomatic: www.Flomatic.com
 2. Val-Matic: www.Valmatic.com
- C. Materials of Construction:
 1. Body: Reinforced Nylon.
 2. Discharge Outlet: Polypropylene.
 3. Rolling Seal: EPDM.
 4. Clamping Stem: Reinforced Nylon.
 5. Float: Foamed Polypropylene.

6. O-Ring: NBR 70.
 7. Base: Reinforced Nylon.
- D. Size: As noted on Drawings.
- E. For air release only valves provide with vacuum guard to allow air discharge only, preventing air intake.

2.15 Y STRAINERS - CLEAR PVC

- A. Size 1/2 inch to 4 inch.
- B. Features:
1. Clear PVC construction.
 2. Seal Material: EPDM.
 3. Replaceable 1/32 inch Type 316 stainless steel perforated screen and O-ring sealed drain plugs.
 4. Easy screen access.
 5. All threaded Y-strainers shall have special reinforced (SR) threads.
 6. Horizontal or vertical installation.
- C. Pressure Rating:
1. Size 1/2" to 2": Rated to 150 psi.
 2. Size 3" to 4": Rated to 90 psi.

2.16 PRESSURE GAUGES

- A. Manufacturers:
1. Ashcroft; Model 1009AW.
- B. Acceptable manufacturers:
1. Omega: www.Omega.com
 2. Enerpac: www.Enerpac.com
- C. Provide with "PLUS" performance option - liquid filled performance in a dry gauge.

- D. Accuracy: 1% full-scale accuracy ASME grade 1A.
- E. Construction:
 - 1. Case & Ring Material: 304 stainless steel.
 - 2. Connection: Bronze.
 - 3. Tube Material: Stainless steel.
 - 4. Window: Polycarbonate.
- F. Sensing Element: Bourdon tube.
- G. Dial Standard: psi.
- H. Dial: Brushed aluminum.
- I. Dial Size: 3-1/2 inch.
- J. Lower Connection: 1/4 inch NPT.
- K. Range: 0 to 60 psi.
- L. Smallest Gradation: 1 psi.

2.17 COMPOUND PRESSURE GAUGES

- A. Manufacturers:
 - 1. Ashcroft; Model 1009AW.
- B. Acceptable manufacturers:
 - 1. Omega: www.Omega.com
 - 2. Enerpac: www.Enerpac.com
- C. Provide with "PLUS" performance option - liquid filled performance in a dry gauge.
- D. Accuracy: 1% full-scale accuracy ASME grade 1A.
- E. Construction:
 - 1. Case & Ring Material: 304 stainless steel.
 - 2. Connection: Bronze.
 - 3. Tube Material: Stainless steel.

- 4. Window: Polycarbonate.
- F. Sensing Element: Bourdon tube.
- G. Dial Standard: psi.
- H. Dial: Brushed aluminum.
- I. Dial Size: 3-1/2 inch.
- J. Lower Connection: 1/4 inch NPT.
- K. Range: 30" Hg VAC to 60 psi.
- L. Smallest Gradation: 1 psi.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. In all piping except air and gas piping, insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.
- C. To prevent thread galling, apply anti-galling lubricant to all stainless steel hardware.
- D. Route piping in orderly manner and maintain gradient. Install piping free of sags, bends, and kinks. Route parallel and perpendicular to walls.

- E. Install fittings in changes in direction and branch connections in hard drawn copper tube.
- F. All piping within structures shall be arranged, and facilities provided, for complete drainage.
- G. Tee fitting sizes shall match that of the largest connecting pipe size.
- H. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- I. All piping serving metering equipment shall be uniformly graded so that air traps are eliminated and complete venting is provided.
- J. Taps for pressure gauge connections on the suction and discharge of pumping units shall be provided with a nipple and a ball type shutoff valve.
- K. Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill immediately after installation.
- L. All chemical piping shall be installed so that lines are readily accessible for cleaning. Tees shall be provided at changes in direction in all chemical piping except chlorine piping, with extra openings plugged, to facilitate cleaning. Teflon thread tape or teflon thread sealer shall be applied to the threads of the plugs so that they can be easily removed. At each point where hose or reinforced plastic tubing is connected to rigid piping, a quick-disconnect coupling shall be provided.
- M. Group piping whenever practical at common elevations.
- N. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- O. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.
- P. Establish elevations of buried water supply piping outside the building to ensure not less than 3.5 ft of cover.
- Q. Provide support for utility meters in accordance with requirements of utility companies.
- R. Excavate in accordance with Section 312316.
- S. Backfill in accordance with Section 312323.
- T. Install bell and spigot pipe with bell end upstream.
- U. Install valves with stems upright or horizontal, not inverted, unless indicated on the plans.
- V. Install water piping to ASME B31.9.

- W. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- X. All pipes passing through structures shall be cast-in-place unless specifically noted otherwise on Drawings.
- Y. Inserts:
1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- Z. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
 2. Support Schedule 40 PVC and CPVC piping as scheduled following:
 - a. 1/4" Diameter: Every 3'-0" minimum.
 - b. 1/2" Diameter: Every 3'-6" minimum.
 - c. 3/4" Diameter: Every 4'-0" minimum.
 - d. 1" Diameter: Every 4'-6" minimum.
 - e. 1-1/4" Diameter: Every 4'-6" minimum.
 - f. 1-1/2" Diameter: Every 5'-0" minimum.
 - g. 2" Diameter: Every 5'-0" minimum.
 - h. 2-1/2" Diameter: Every 5'-6" minimum.
 - i. 3" Diameter: Every 6'-6" minimum.
 - j. 4" Diameter: Every 6'-6" minimum.
 - k. 6" Diameter: Every 7'-6" minimum.
 - l. 8" Diameter: Every 8'-6" minimum.
 - m. 10" Diameter: Every 9'-0" minimum.
 - n. 12" Diameter: Every 9'-6" minimum.

3. Support Schedule 80 PVC and CPVC piping as scheduled following:
 - a. 1/4" Diameter: Every 4'-0" minimum.
 - b. 1/2" Diameter: Every 4'-6" minimum.
 - c. 3/4" Diameter: Every 4'-6" minimum.
 - d. 1" Diameter: Every 5'-0" minimum.
 - e. 1-1/4" Diameter: Every 5'-0" minimum.
 - f. 1-1/2" Diameter: Every 5'-6" minimum.
 - g. 2" Diameter: Every 6'-0" minimum.
 - h. 2-1/2" Diameter: Every 6'-0" minimum.
 - i. 3" Diameter: Every 7'-0" minimum.
 - j. 4" Diameter: Every 7'-6" minimum.
 - k. 6" Diameter: Every 9'-0" minimum.
 - l. 8" Diameter: Every 9'-6" minimum.
 - m. 10" Diameter: Every 10'-0" minimum.
 - n. 12" Diameter: Every 11'-6" minimum.
 - o. 14" Diameter: Every 12'-6" minimum.
4. Place hangers within 12 inches of each horizontal elbow.
5. Provide copper plated hangers and supports for copper piping.

AA. Auxiliary Drill & Tap Connections:

1. Sch 80 fittings may be drilled and tapped for auxiliary connections provided the following limitations are adhered to in order to ensure proper fitting and joint integrity are maintained.
 - a. 1/8" and 1/4" tapped connections may be made only on 2" and larger nominal size fittings. 1/2" tapped connections may be made only on 4" and larger fittings. 3/4" tapped connections may be made only on 6" and larger fittings.
 - b. Tapped connections must be located in the double-walled solvent cement joint between the fittings and pipe. Do not tap through the fitting wall at any other location.

- c. Tap center must be located at the lower 1/3 of the fittings socket depth. Do not locate tap center in the upper 2/3 of the joint or at the very bottom of the socket.
- d. Drill appropriate pilot hole squarely through the fitting and pipe wall using moderate speed to prevent distortion of the plastic material. Hand tapping is recommended to likewise prevent distortion and possible thread damage. Do not use a drill for tapping.
- e. Tap dry or with water only. Do not use any cutting oils in the tapping process. These can induce stress cracking in plastics.
- f. Threaded connections must be made using a thread sealant as approved by the pipe manufacturer. The use of thread sealants not approved by the pipe manufacturer may cause stress cracking in plastics.

3.4 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- E. Provide plug valves in natural gas systems for shut-off service.

3.5 TOLERANCES

- A. When pipe elevations are shown on the Drawings, the pipe shall uniformly slope between the given elevations. If Contractor believes additional change in direction fittings are required in order to achieve the slopes shown, then Contractor shall notify Engineer prior to installation.
- B. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- C. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.6 PRESSURE AND LEAKAGE TESTING

- A. All specified tests shall be made by and at the expense of the Contractor in the presence, and to the satisfaction of the Engineer.

- B. Each piping system shall be tested for at least 1 hour and with no loss of pressure.
- C. Piping shall be tested at the following pressures:
 - 1. Recirculation Piping:
 - a. Test Pressure: 1-1/2 times working pressure but not less than 50 psi.
 - b. Test Medium: Water.
 - 2. Water Supply:
 - a. Test Pressure: 1-1/2 times working pressure but not less than 120 psi.
 - b. Test Medium: Water.
 - 3. Gas Supply:
 - a. Test Pressure: 1-1/2 times working pressure but not less than 60 psi.
 - b. Test Medium: Compressed air.
 - 4. Other Piping:
 - a. Test Pressure: 1-1/2 times working pressure but not less than 50 psi.
 - b. Test Medium: Suitable fluid or gas.
- D. Compressed air or pressurized gas shall not be used for testing plastic piping unless specifically recommended by the pipe manufacturer.
- E. Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or positive and accurate method acceptable to the Engineer. All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as required during the testing.
- F. All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of the Contractor and at the time directed by the Engineer.
- G. All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

3.7 CLEANING

- A. The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed

in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of the Engineer.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.9 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

END OF SPEC SECTION 131190

SECTION 131192 - PLUMBING SPECIALTIES FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Drain valves.
- B. Water meter for water fill or water make-up.
- C. Emergency eye/face wash and shower.

1.2 RELATED REQUIREMENTS

- A. Section 13 11 90 - Piping and Valves for spray grounds

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 DRAIN VALVES

- A. Exterior Finish: Brass.
- B. Packing: Teflon impregnated packing.
- C. Packing Nut: Adjustable brass nut with deep stem guard.
- D. Valve Seat: Standard "O" size washer.

E. Handles: Furnished with polycarbonate wheel handle.

2.2 WATER METER FOR WATER FILL OR WATER MAKE-UP

A. Wetted Materials:

1. Body: Brass.
2. Couplings: Brass.
3. Measuring Chamber: ABS Plastic.

B. Flow Range (for 1" model): 50 gpm max; 3-50 gpm nominal; 0.75 gpm transitional.

C. Accuracy: +/-3% transitional flow; +/-1.5% nominal flow.

D. Temperature Limit: 122 degrees F.

E. Pressure Limit: 150 psi.

F. Totalizing Display Maximum: 9,999,999.99 gal.

G. Output Signal: Pulse output with frequency proportional to flow rate.

H. Pulse Options: 0.1 gal, 1 gal, 10 gal, 100 gal per pulse.

I. Electrical Rating: 0.01A @ 24 VAC/DC.

J. Electrical Connections: Color-coded lead wires 4.5 feet long.

K. Mounting Orientation: Horizontal with register facing up.

L. Agency Approvals: NSF/ANSI 61.

M. Size: As indicated on drawings.

2.3 EMERGENCY EYE/FACE WASH AND SHOWER

A. Specified Manufacturer: Guardian Equipment; Model G1993; Tel: (312) 447-8100.

B. Acceptable manufacturers:

1. Haws: www.Hawscow.com
2. Bradley: www.BradleyCorp.com

a. Application:

- 1) All PVC and PVC-coated combination eye/face wash and shower safety station.
- b. Shower:
 - 1) Head: 10"-diameter orange ABS plastic.
 - 2) Valve:
 - (a) 1" IPS PVC-coated brass stay-open ball valve.
 - (b) Chrome-plated brass ball.
 - (c) Teflon seals.
 - (d) Stainless steel actuating arm and 29" stainless steel pull rod.
 - 3) Spray head assembly: Internal flow control and filter to remove impurities from water.
- c. Eye/Face Wash:
 - 1) Bowl: 11-3/4" orange ABS plastic.
 - 2) Valve:
 - (a) 1/2" IPS PVC-coated brass stay-open ball valve.
 - (b) Chrome-plated brass ball.
 - (c) Teflon seals.
- d. Pipe and Fittings: Schedule 80 PVC.
- e. Supply: 2" IPS socket weld top female inlet.
- f. Waste: 2" IPS socket weld female outlet.
- g. Sign: Furnished with ANSI-compliant identification sign.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on all plumbing lines where contamination of domestic water may occur.
- F. A reduced pressure zone backflow preventer shall be installed at each cross connection to prevent backsiphonage and back-pressure backflow of hazardous materials into the potable water supply.
- G. Pipe relief from backflow preventer to nearest drain with approved air-gap.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SPEC SECTION 131192

SECTION 131194 - MECHANICAL IDENTIFICATION FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.2 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc.: www.Champion-America.com.
- C. Kolbi Pipe Markers, Inc.: www.kolbipipemarkers.com.
- D. Marking Services Inc. (MSI): www.markserv.com.
- E. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.

2.3 VALVE TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved letters. Tag size minimum 1-1/2 inch diameter.

- B. Valve Tag Securing Devices: Plastic zip tie; provide one securing device for each tag.

2.4 PIPE MARKERS

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Identify all pumps, heaters, filters tanks, with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify all valves in exposed recirculation piping and remote pits with tags.
- F. Identify exposed piping with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

3.3 SCHEDULES

- A. Nameplates:
- B. Valve Tags:
 - 1. Identification: Each valve tag shall have the words identified below. Valve tags with codes or abbreviations are not acceptable.
 - a. Air Release Valve: Located on all ball valves used to release air from hydraulic system.

- b. Automatic Air Release Valve: Located on top of filters and at high points of piping system to automatically release air.
 - c. Backwash Isolation Valve: Located on the filter face piping to backwash filter.
 - d. Backwash Throttling Valve: Located on the pipe run from the filter face piping to the backwash pit.
 - e. Bypass Valve: Located on a pump discharge pipe to bypass water flow back into a wet pit.
 - f. Check Valve: Locate on all check valves.
 - g. Drain Valve or Drain Plug: Locate on all valves or plugs used for drainage.
 - h. Filter Effluent Valve: Located on discharge side of filters.
 - i. Filter Influent Valve: Located on filter face piping directly before filter.
 - j. Isolation Valve: Located before and after equipment including pumps, strainers, etc.
 - k. Manual Fill Valve: Locate on valve used to fill pit.
 - l. Drain Valve: Used to drain water out of the basin, generally through the main drain.
 - m. Recirculation Throttling Valve: Located on recirculation piping after the filters.
 - n. Solenoid Valve: Valve that is electrically operated.
 - o. "WATER FEATURE NAME" Throttling Valve (e.g. Open Flume Slide Throttling Valve, Drop Slide Throttling Valve, Bubbler): Located on individual water feature valves downstream of pump.
 - p. Other: Provide valve tags for all other valves not specifically identified above. Verify wording with Engineer.
2. Background:
- a. Size: As required.
 - b. Color: To match color of pipe markers for the respective pipe - see pipe marker schedule below.
3. Lettering:

- a. Color: To match color of pipe markers for the respective pipe - see pipe marker schedule below.
 - b. Height: 1/4 inch.
- C. Pipe Markers: Unless otherwise required by local codes, the color codes for piping shall be as follows.
- 1. Air Release Piping: All piping used to manually or automatically release air.
 - a. Identification: Air Release.
 - b. Background:
 - 1) Size: As required.
 - 2) Color:
 - (a) Piping on filter influent piping or top of filters: Olive Green.
 - (b) Piping on filter effluent piping: Aqua.
 - c. Lettering:
 - 1) Color: White.
 - 2) Height: 1/2 inch.
 - 2. Chemical Controller Sample Lines:
 - a. Chemical Controller Return: Sample coming from the chemical controller.
 - 1) Identification: Chemical Controller Return.
 - 2) Background:
 - (a) Size: As required.
 - (b) Color: Aqua.
 - 3) Lettering:
 - (a) Color: White.
 - (b) Height: 1/2 inch.
 - b. Chemical Controller Supply: Sample line going to the chemical controller.

- 1) Identification: Chemical Controller Supply.
 - 2) Background:
 - (a) Size: As required.
 - (b) Color: Aqua.
 - 3) Lettering:
 - (a) Color: White.
 - (b) Height: 1/2 inch.
3. Chemical Piping:
- a. Identification: "CHEMICAL NAME" (e.g. Muriatic Acid, Sodium Hypochlorite, Chlorine Gas, Caustic Soda).
 - b. Background:
 - 1) Size: As required.
 - 2) Color:
 - (a) Chlorine (gas or solution): Yellow.
 - (b) Soda Ash: White.
 - (c) Acid: Pink.
 - (d) Caustic: Yellow with Green Band.
 - c. Lettering:
 - 1) Color: Black.
 - 2) Height: 1/2 inch.
4. Domestic Water:
- a. Deck Hose Bibb Supply: Locate on exposed deck hose bibb supply pipes where exposed for distances of greater than 5' or when pipe penetrates multiple structures.
 - 1) Identification: Deck Hose Bibb.
 - 2) Background:
 - (a) Size: As required.

- (b) Color: Dark Blue.
- 3) Lettering:
 - (a) Color: White.
 - (b) Height: 1/2 inch.
- b. Fill: Locate on all manual fill piping.
 - 1) Background:
 - (a) Size: As required.
 - (b) Color: Dark Blue.
 - 2) Lettering:
 - (a) Color: White.
 - (b) Height: 1 inch.
- c. Water Make-Up: Locate on all automatic water make-up piping.
 - 1) Background:
 - (a) Size: As required.
 - (b) Color: Dark Blue.
 - 2) Lettering:
 - (a) Color: White.
 - (b) Height: 1/2 inch.
- d. Water Service: Locate on potable water service piping only where exposed for distances of greater than 3' or when pipe penetrates multiple structures.
 - 1) Identification: Water Service.
 - 2) Background:
 - (a) Size: As required.
 - (b) Color: Dark Blue.
 - 3) Lettering:

- (a) Color: White.
 - (b) Height: 1 inch.
- 5. Filter Backwash: Filter backwash piping.
 - a. Identification: Filter Backwash.
 - b. Background:
 - 1) Size: As required.
 - 2) Color: Dark Brown.
 - c. Lettering:
 - 1) Color: White.
 - 2) Height: 2 inch.
- 6. Main Drain Piping: Locate on main drain piping only where the pipe is exposed for distances of greater than 5'. If less than 5' of pipe is exposed, locate on penetrating wall(s) immediately above the pipe.
 - a. Background:
 - 1) Size: As required.
 - 2) Color: Black.
 - b. Lettering:
 - 1) Color: White.
 - 2) Height: 2-1/2 inch.
- 7. Recirculation Piping:
 - a. Filter Effluent Piping: Piping after filters.
 - 1) Background:
 - (a) Size: As required.
 - (b) Color: Aqua.
 - 2) Lettering:
 - (a) Color: White.

- (b) Height: 2 inch.
 - b. Filter Influent Piping: Piping between recirculation pump and filter.
 - 1) Background:
 - (a) Size: As required.
 - (b) Color: Olive Green.
 - 2) Lettering:
 - (a) Color: White.
 - (b) Height: 2 inch.
8. Sump Pump Discharge Piping:
- a. Backwash Sump Pump Discharge Piping: Exposed piping on backwash sump pump discharge.
 - 1) Identification: Backwash Sump Pump.
 - 2) Background:
 - (a) Size: As required.
 - (b) Color: Dark Brown.
 - 3) Lettering:
 - (a) Color: White.
 - (b) Height: 1/2 inch.
 - b. Sump Pump Discharge Piping: Exposed piping on sump pump discharge piping to storm sewer.
 - 1) Identification: Sump Pump.
 - 2) Background:
 - (a) Size: As required.
 - (b) Color: Light Brown.
 - 3) Lettering:
 - (a) Color: White.

(b) Height: 1/2 inch.

9. Water Feature Piping: Piping to water features.

a. Identification: "WATER FEATURE NAME" (e.g. Open Flume Water Slide, Drop Slide, Bubbler).

b. Background:

1) Size: As required.

2) Color: Olive Green.

c. Lettering:

1) Color: White.

2) Height: 1/2 inch on small pipe, 2 inch on large pipe.

END OF SPEC SECTION 131194

SECTION 131420 - WATER SPRAY FEATURES FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water spray features.

1.2 PRE-QUALIFICATION REQUIREMENTS

- A. The Contract Documents are based on providing the products of the Specified Manufacturer. Acceptable Manufacturers shall have their proposed substitute products submitted to Engineer at least 14 days prior to bidding in order to be considered for this project. If approved by Engineer, notification will be indicated in an Addendum.
- B. Acceptable Manufacturers shall submit their proposed substitute for each of the products specified including the following:
 - 1. A point-by-point comparison of the proposed substitute products to that of the Specified Manufacturer's products. Comparison shall include, but not necessary limited to, materials of construction, flow requirements, operating pressure requirements, installation requirements, and anchor base details.
 - 2. Specific written notice of any and all variations of the proposed substitute with that of the Specified Manufacturer.
 - 3. A colored picture of each product or feature while in use or operation.
 - 4. A list of references including project location, project completion date, and contact name and phone number.
- C. Substitute products shall provide the same water effect and similar hydraulic performance as the product specified.
- D. All quantities of each product shall match that being provided by the Specified Manufacturer.
- E. All piping, fittings, valves, and appurtenances shall be as indicated on the drawings and all costs for materials and installation for a complete and operating piping system shall be included in the Bid. If deviations are required for a specific manufacturer's product, the Engineer will indicate such deviation in an Addendum as part of the manufacturer's approval. The necessary cost add or deduct for such indicated changes shall be included in the bid.
- F. If this section includes a wireless systems by the Specified Manufacturer and the Acceptable Manufacturer can not provide a wireless system, then the Acceptable Manufacturer shall indicate so in the pre-qualification submittal. If a hard-wired system is approved by Engineer, Contractor shall be responsible for providing all necessary

conduit, conductors, junction boxes, etc. for a complete and operating system in accordance with the Acceptable Manufacturers requirements.

1.3 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for specified systems, including all components.
- C. Shop Drawings: Indicate component connection details and details of interface with adjacent construction.
- D. Certificates: Certify that products of this section meet or exceed specified requirements.
- E. Manufacturer's Instructions: Indicate installation instructions for specified equipment, including each component.
- F. Operation and Maintenance Data: Submit manufacturer's maintenance instructions and parts lists for specified equipment.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.
- C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Delivery: Deliver materials to site in manufacturer's original, unopened packaging.
- B. Storage: Store all equipment and materials under cover and elevated above grade.
- C. Protection: Protect equipment and materials to prevent damage.

1.6 WARRANTY

- A. Stainless steel pipe and anchor bases shall be warranted against structural failure for a period of 25 years.
- B. Coatings shall be warranted for a period of 2 years against peeling or fading, under normal environmental conditions.

- C. Controllers, Valve Boxes, and Fiberglass Components:
 - 1. Dynamic Sequencing Control Module 02-6210 shall be warranted against defects for a period of 3 years. All other dynamic sequencing controllers shall be warranted against defects for a period of 1 year.
 - 2. Valve boxes and fiberglass components shall be warranted against defects for a period of 3 years.
- D. Nozzles shall be warranted for a period of 5 years.
- E. Polyurethane components shall be warranted for a period of 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Specified Manufacturer: Water Odyssey play elements manufactured by The Fountain People, Inc.: Tel: (512) 392-1155; www.waterodyssey.com.
- B. Acceptable Manufacturers: Acceptable Manufacturers shall have their proposed substitute products submitted to Engineer in accordance with Part 1 - Pre-Qualification Requirements of this Section.
 - 1. Aquatix by Landscape Structures; 6500 Eden Prairie, MN 55346-1729: Tel: (877) 632-0503; Fax: (952) 345-6444.
 - 2. Vortex Aquatic Structures International; Tel: (514) 694-3868; Fax: (514) 335-5414; www.vortex-intl.com.
 - 3. Waterplay Manufacturing Inc.; 1451 B. Ellis St., Kelowna, BC V1Y 2A3: Tel: (800) 590-5552 or (250) 712-3393; Fax: (250) 861-4814; www.waterplay.com.

2.2 WATER SPRAY FEATURES

- A. Caittails Too - W351
- B. Crookett - C029
- C. Dew Buckets - W356
- D. Directional Eyeball Jet - W086
- E. Jet Way - W011
- F. Salmon Head - FFSH-W23603 (to be painted as trout)

- G. Salmon Tail - FFST-W23603 (to be painted as trout)
- H. Single Water Ring - W238-1
- I. Large Stone Aqua Spout - FF0014

2.3 DRAIN

- A. Decorative Drain - W037-H

2.4 ACTIVATOR

- A. Touch & Go Bollard - W009

2.5 MANIFOLD

- A. Distribution Header: Type 304 stainless steel pipe.
- B. Solenoid Valves: Die cast bronze with 15' cord and 24 volt AC UL recognized solenoid.
- C. Balancing Valves: True union ball valve, Schedule 80 PVC.
- D. Inlet Isolation Valve: True union ball valve, Schedule 80 PVC.
- E. Water Hammer Arrestor: copper and brass construction with pre-set operating pressure 10-35 psi.
- F. Drain Valve: 3/4 inch cast bronze hose bibb located on the bottom of the header.
- G. Pressure Gauge: Discharge Pressure Gauge: Tru-Tel #3550BC4L1D6F, 0 to 60 psi.
- H. A. HDG, S.S. or FRP channel support system

2.6 CONTROLLER

- A. Dynamic Sequencing Controller - DSC-8-16

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that required utilities are in correct location and are of correct capacities for specified products.

- B. Verify equipment rough-in before proceeding with work.

3.2 INSTALLATION

- A. Install all equipment in accordance with shop drawings and manufacturer's printed installation instructions; comply with standards required by authorities having jurisdiction.
- B. Schedule installation to ensure that utility connections are achieved in an orderly and expeditious manner.
- C. Install equipment plumb, square, and straight, without distortion; securely anchor.

3.3 INTERFACE WITH OTHER WORK

- A. Coordinate with other trades for proper installation of plumbing and electrical services.

3.4 STARTING EQUIPMENT AND SYSTEMS

- A. Provide manufacturer's field representative to prepare and start equipment.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

3.5 ADJUSTING AND CLEANING

- A. Adjust equipment, including water requirements, for smooth operation.
- B. Touch up minor damaged surfaces caused by installation.
- C. Replace damaged components as directed by Engineer.

3.6 CLEANING AND PROTECTION

- A. Clean all pieces of equipment.
- B. Protect installed equipment from subsequent construction operations.
- C. Do not permit traffic over unprotected surfaces.

END OF SPEC SECTION 131420

SECTION 220100 - GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1) and Section 260113 - Electrical Connections, apply to the work specified in DIVISION 22 – PLUMBING. The plumbing contract includes all labor, materials and equipment required for the complete plumbing systems as shown and herein specified.
- B. Provide all devices and accessories as necessary for complete and working systems.
- C. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.

1.2 QUALITY ASSURANCE

- A. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.
- B. All equipment of one type (such as fixtures, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.
- C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.
- D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.3 SHOP DRAWINGS AND SUBMITTALS

- A. Shop drawings shall be submitted as specified in Section 013300 submittals. Product data shall be submitted for all materials and equipment specified in DIVISION 23.

1.4 PROJECT SEQUENCING

- A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.
- B. All temporary valves, dampers, etc. not indicated, but required by phasing, shall be included in the base bid.

1.5 SUBSTITUTIONS

- A. Refer to Section 006325 – Product Substitution Request.

1.6 DEFINITIONS

- A. Furnish: The term “furnish” is used to mean “supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.”

- B. Install: The term “install” is used to describe operations at the project site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”
- C. Provide: The term “provide” means “to furnish and install, complete and ready for the intended use.”

1.7 RECORD DRAWINGS

- A. During the progress of the work of this section, this Contractor shall maintain an accurate record of all changes made in the installation of the system(s). Upon completion of the work, accurately transfer all record information in AutoCad format. Provide final record drawings on CR-ROM and three plotted sets. Insert one set into each of the operation and maintenance manuals described below.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Before project close-out, submit three copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment. Include in the manual a set of as-built prints.
- B. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.
- C. At the completion of the project furnish to the Architect for the Owner, three (3) copies of brochures in three ring notebook form, divided and tabbed, containing all data, diagrams, as-built plans, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.9 CODES AND ORDINANCES

- A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.
- C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 OWNER TRAINING

- A. Refer to Section 017900.

1.11 WARRANTY

- A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.
- B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects

at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.
- B. Capacities of equipment and materials shall not be less than those indicated.
- C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.
- D. Provide 3-1/2" concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.
- E. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.
- F. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.2 EQUAL PRODUCTS OF LISTED MANUFACTURERS

- A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.
- B. Where other manufacturer's names are listed, they are considered an acceptable manufacturer for the product specified.
- C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical, electrical, structural, or architectural requirements as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.
- B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, piping, ducts, conduit, air devices, or squeaks in rotating equipment will not be acceptable.
- C. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each

contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.

- D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.
- E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.
- F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.
- G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems requiring same. Owner's operating personnel shall be present during this operation.
- H. It is the contractor's responsibility to provide materials and trim which properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.
- I. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

3.2 CONNECTIONS TO BUILDING STRUCTURE

- A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.
- B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.3 CLEANING

- A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.4 VISIT TO THE SITE

- A. Before submitting his bid, the Contractor shall visit the location of the job and shall fully understand the scope of the work to be done and the conditions under which it is to be performed. In no case shall additional compensation be granted when existing conditions could reasonably be determined.

3.5 EXISTING UTILITIES

- A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.
- B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.
- C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.

- D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

END OF SECTION 220100

SECTION 220513 - ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The contractors responsible for Division 22 work shall coordinate with the Electrical Contractor to insure electrical and controls of the proper size are furnished. Further, the Plumbing Contractor shall furnish all electric control items indicated to the Electrical Contractor for installation and connection, unless noted otherwise.
- B. Refer to Section 260113 - ELECTRICAL CONNECTIONS for required electrical connections.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

- A. The Electrical Contractor shall provide all motor starters required for equipment provided in the mechanical contract that is not integral with equipment.

PART 3 - EXECUTION

3.1 MOTOR STARTERS

- A. The Plumbing Contractor shall coordinate all motor starters type and size with the Electrical Contractor to insure compatibility with the motors provided in this contract.

ITEM	Furnished By	Set By	Power Wiring	Control Wiring
Pumps	PC	PC	EC	EC
Loose motor starters, disconnect switches, thermal overloads and heaters.	EC	EC	EC	EC

PC = Plumbing Contractor

EC = Electrical Contractor

END OF SECTION 220513

SECTION 220514 - SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the services as shown on plans and specified.

1.2 UTILITY FEES

- A. The Contractor shall pay any and all required utility service fees associated with this project.

1.3 UTILITY CONNECTION COORDINATION

- B. This Contractor shall provide all service piping and accessories required to complete connection and not furnished by the serving utility. It is the responsibility of this Contractor to coordinate with the serving utility company regarding the items furnished, the work performed, inspections required, and any associated permits.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 SERVICES

- C. This Contractor shall terminate gas, water, storm, and sewer lines at a point approximately five feet from the building wall or as shown on the drawings. This Contractor shall make connection to the various services provided by others; coordinate all connection requirements with civil engineer. Installation of utility connections shall be in complete conformance with all regulations having jurisdiction, and the requirements of each serving utility.

END OF SECTION 220514

SECTION 220515 - PLUMBING RELATED WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The following is the work required by the General Contractor to facilitate the work of the Mechanical Contractor.
 - 1. Openings and chases.
- B. The following is the work required by the Mechanical Contractor to facilitate the work of his Contract.
 - 1. Cutting and patching.
 - 2. Excavation and backfilling.
 - 3. Pipe sleeves.

1.2 RELATED DOCUMENTS

- A. Refer to Division 2 for backfilling requirements.
- B. Unless otherwise addressed in the specification, as a minimum, backfill in 6" lifts, compacting to a minimum of 90%. The first 12" of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 GENERAL CONTRACTOR'S WORK

- A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Plumbing Contractor and to refinish around same. The Plumbing Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.2 MECHANICAL CONTRACTOR'S WORK

- A. The Mechanical Contractor shall be responsible for locating and setting his own pipe sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.
- B. The Mechanical Contractor shall be responsible for cutting his own holes in existing construction and for patching and finishing around same, unless noted otherwise, to the satisfaction of the Architect. Any holes left in walls when existing pipe is removed by this Contractor shall be patched and finished by this Contractor.
- C. The Mechanical Contractor shall do all excavating and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed or braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent. The bottoms of trenches shall be tamped hard and graded to secure the required fall before laying pipe. Bell holes

shall be excavated so the pipe will rest on solid ground for its entire length.

- D. Hand backfill and tamp backfill into place at sides of pipes, leaving tops and joints exposed until pipe runs have been tested and approved.
- E. All sidewalks, streets, or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

END OF SECTION 220515

SECTION 220519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide gauges and thermometers as specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide devices by one of the following manufacturers.
 - 1. Marshalltown
 - 2. Terice
 - 3. Weiss Instruments
 - 4. Weksler Instruments
 - 5. Miljoco
 - 6. US Gauge
 - 7. Crosby

2.2 THERMOMETERS

- A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
- B. Scale range: Temperature ranges for services listed as follows:
 - 1. Domestic Hot Water: 30 to 240 deg with 2-degree scale divisions (0 to 115 deg C with 1-degree scale divisions).
 - 2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).
- C. Thermometers
 - 1. Provide adjustable, red reading tube thermometer where shown.

2.3 PRESSURE GAUGES

- A. Dial type with enameled steel or cast aluminum case, white dial, case relief vent, recalibration device and AISI 316 stainless steel Bourdon tube, tip and socket.
- B. Gauges shall be installed with brass pipe fittings, unions, gauge cock, and pulsation dampers.
- C. Unless indicated otherwise, ranges on gauges shall be as follows:

1. 0-160 psi - Water service entrance
2. 0-100 psi - Domestic water system

PART 3 - EXECUTION

3.1 THERMOMETERS INSTALLATION

- A. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.
- B. Install in the following locations, and elsewhere as indicated:
 1. At outlet of each water heater.

3.2 INSTALLATION OF PRESSURE GAGES

- A. Install in the following locations, and elsewhere as indicated:
 1. At building water service entrance.
 2. At inlet and discharge of pressure reducing stations.

END OF SECTION 220519

SECTION 220523 - PIPING SPECIALTIES AND VALVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Valves shall be installed at locations shown and specified; the locations shall be accessible. All valves shall be installed with their stems or spindles horizontal or above.
- B. Provide unions or grooved mechanical couplings where shown at all equipment connections and at other points where disconnection of piping will be required.
- C. Strainers shall be provided at locations shown.

1.2 APPROVED MANUFACTURERS

- A. The basis for the valve specification is Nibco and MEPCO and shall represent the minimum level of construction. Equipment manufactured by NVent, Apollo, Milwaukee, and Victaulic shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 VALVES

- A. Bronze or brass ball valves rated at 150 psi SWP and 600 psi WOG, shall have two or three piece stainless steel, cast bronze, or brass bodies with TFE seats, stainless steel full port ball, separate packing nut with adjustable stem packing, and anti-blowout stem. Valves ends shall have full depth ANSI, Vic-Press™, or extended solder connections, and manufactured to comply with MSS-SP 110, shall be used in 3" and smaller copper and steel lines for domestic water duties. NVent PL-200, Victaulic Series 569, NIBCO T585-70-66, Jomar T/S 100-SS-n in uninsulated applications and NIBCO T585-70-66-EL in insulated lines. Victaulic Series 726 when using grooved end valves.
- B. Y-pattern swing-type check valve manufactured in accordance with MSS-SP 80, Class 150 psi B62 cast bronze body shall be used in 2 1/2" and smaller lines for domestic water duties. NIBCO T-433Y, Jomar T/S 511. Victaulic Series 712 when using grooved end valves.
- C. Victaulic / TA Hydronics Series 787 or 786, MEPCO model MBVT, or engineer approved equal NIBCO T or S-1710, bronze body, globe style manual valve with flow measuring taps shall be used for all balancing valves 2" and smaller for domestic water duties.
- D. Nibco, or engineer approved equal, bronze or brassball valves rated at 150 psi SWP and 600 psi WOG, shall have two piece cast bronze or brass bodies with TFE seats, stainless steel full port ball, separate packing nut with adjustable stem packing, and anti-blowout stem. Valves with threaded ends, shall be used in 3" and smaller steel lines for all natural gas duty. Valve to be NIBCO T585-70-UL or Jomar T100NE with U.L. listing and CSA listing.

2.2 UNIONS

- A. Screwed or solder type ground joint unions shall be used on piping 2" and smaller. Flanged connections shall be used on pipe 2 1/2" and larger.
- B. Unions are not required in installations using Victaulic grooved plumbing couplings.

- C. Unions shall not be installed in walls or partitions or above non-accessible ceilings.
- D. Pressure ratings on unions shall be equal to or greater than the lines they are in.
- E. Dielectric unions or Victaulic Style 47 dielectric waterway fittings shall be used where copper lines connect to other types of materials.

2.3 ESCUTCHEONS

- A. Provide nickel-brass or chrome plated escutcheons on exposed pipes where they pass through walls, ceilings, and base cabinet penetrations.

2.4 STRAINERS

- A. Provide Victaulic, Watts, Dunham, or engineer approved equal, strainers where shown with pressure ratings equal to or greater than line operating pressure.
- B. Provide ball valves in blowoff tapping of all strainers.
- C. Strainers screens shall be stainless steel with 1/8" perforations for water service.

PART 3 - EXECUTION

END OF SECTION 220523

SECTION 220529 - PIPING SUPPORTS, ANCHORS AND SEALS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide piping support, anchors, and seals as specified and indicated on drawings.
- B. Pipe shall not pass through footings or beams without the consent of the Architect.

1.2 SUBMITTALS

- A. Shop drawings of the fire-stopping method shall be approved prior to the setting of any sleeves and shall clearly define the UL fire-stopping method and required sleeve clearances.

1.3 APPROVED MANUFACTURERS

- A. The basis for pipe hangers is B-Line Systems Inc. and shall represent the minimum level of construction. Equipment manufactured by Erico and Grinnell shall be permitted to bid these specifications.
- B. The basis for roof supports is Dura-Blok as manufactured by B-Line Systems Inc. and shall represent the minimum level of construction. Equivalent products shall be permitted to bid these specifications upon submission for approval.

PART 2 - PRODUCTS

2.1 HANGERS AND SLEEVES

- A. All insulated horizontal piping shall be supported from outside the insulation. Provide inserts and saddles as recommended by the insulation manufacturer.
- B. Pipe hangers for lines 1/2" to 2" shall be adjustable swivel ring hanger equal to B-Line Figure B-3170NF and B-3170CT for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger swivel rings. Upper ends supported as hereinafter specified with the proper B-Line upper attachments.
- C. Pipe hangers for lines 2 1/2" to 4" shall be light duty clevis hanger equal to B-Line Figure B-3104 and B-3104CT for ferrous and copper piping respectively with hanger rods in diameters as required by the hanger rod holes. Upper ends supported as hereinafter specified with the proper B-Line upper attachments.
- D. Provide B-Line Figure B-3373 and B-3373CT riser clamps for ferrous and copper piping, respectively, at each floor and at other locations where vertical support is necessary.
- E. Pipe sleeves will be required in all pipe and duct penetrations through new exterior walls, masonry walls, floors and fire rated gyp. board walls. Sleeves shall be either Schedule 5 steel pipe, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by U.L. listed fire-stopping system.
- F. Pipe sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling".

PART 3 - EXECUTION

3.1 PIPE SLEEVES

- A. Space between sleeves and pipes in outside walls shall be filled or tightly caulked with oakum, butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Pipe sleeve shall be sufficient diameter to provide approximately 1/2" clearance around pipe, and in the case of insulated pipe, approximately 1/2" around insulation.
- B. Space between sleeves and pipes in other wall construction shall be diameter as required to provide the clearance required by the U.L. listed fire-stopping method chosen by the Contractor.
- C. Sleeves shall be set no closer than three pipe diameters center to center, be set 3/4" past all wall surfaces, and securely anchored to the wall.

3.2 PIPE HANGERS

- A. Upper ends of hanger rods shall be supported angle iron laid across top chord of bar joists, or from side beam clamps in steel structure.
- B. Upper ends of hanger rods in other construction types shall be as recommended by the Structural Engineer of record.
- C. Hanger and support spacing for horizontal steel and copper piping shall not exceed the values given in the following table:

NOMINAL PIPE SIZE	STEEL PIPE	COPPER PIPE
1/2" - 1-1/4"	7'	5'
1-1/2" - 2"	9'	6'
2-1/2" - 3"	11'	10'
4"	14'	10'
6"	17'	--
8"	19'	--
10" - 12"	22'	--

- D. Soil, waste, vent and drain pipe as well as roof drain lines shall have a minimum of one hanger per pipe section at the joints and at changes in direction and branch connections. If FM approved couplings are used, pipe may be hung with one hanger per 10 foot lengths and at every third fitting where they are contiguous in conformance with manufactures installation instructions.
- E. No pipe hanger rod shall be less than 6" in length unless otherwise shown or approved.
- F. Spacing of supports and braces for exposed vertical piping shall not exceed the hanger spacing specified for horizontal pipe, unless otherwise indicated.

3.3 FLASHINGS

- A. All vent pipes passing through the roof shall be flashed by the roofing contractor.

END OF SECTION 220529

SECTION 220550 – TESTING AND ADJUSTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide testing and adjusting of the systems as specified and indicated on drawings.
- B. Systems shall be fully tested, before covering or concealing, in the presence of the Owner's representative.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 PIPING SYSTEMS, INTEGRITY TEST

- A. The following piping systems shall be fully tested before covering and concealing in the presence of the Owner's representative. All leaks shall be repaired in a satisfactory manner.
 - 1. Domestic water piping interior lines shall be tested in accordance with the IPC/UPC as follows:
 - a. Hydrostatically tested at 100 psi (or system pressure) for a period of 1 hour with no drop in water pressure.
 - b. Air tested at minimum 50 psi for 20 minutes with no loss of pressure.
- B. Soil, waste, vent and roof drain pipe underground shall be tested before complete covering. This test shall be made by extending a 10' length of pipe vertically, temporarily caulking, and filling with water. This test shall remain 12 hours.
- C. Soil, waste, vent and roof drain pipe in the building shall be tested in accordance with IPC/UPC as follows:
 - 1. Minimum hydrostatic pressure of 10 feet of water for a period of 1 hour with no drop in water level. System shall be visually inspected after the 1 hour duration for leaks
 - 2. Air tested at minimum 5 psi for 20 minutes with no loss of pressure.

3.2 OTHER REQUIREMENTS

- A. All flush valves, faucets and other plumbing items shall be properly adjusted.
- B. Domestic water piping system shall be purged of deleterious matter and disinfected prior to utilization per IPC as follows:
 - 1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlets.
 - 2. The system, or part thereof, shall be filled with a water/chlorine solution containing at least 50 ppm of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine

solution containing 200 ppm of chlorine and allowed to stand for 3 hours.

3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

END OF SECTION 220550

SECTION 220553 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide HVAC identification as specified and indicated on the drawings.
- B. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment markers
 - 2. Access panel and door markers
 - 3. Pipe markers
 - 4. Valve tags
 - 5. Valve schedules

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve Schedules: Provide valve numbering scheme and identification type for each piping system. Furnish extra copies (in addition to mounted copies) to include in Operation and Maintenance Manuals.

1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of insulation and jacketing surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
 - 1. Seton
 - 2. Brady
 - 3. Craftmark
 - 4. Brimar Industries, Inc.

2.2 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Markers: Engraved, color-coded laminated plastic.

1. Terminology: Match schedules as closely as possible.
 2. Data:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 3. Size: 2-1/2" by 4" for control devices, dampers, and valves; 4-1/2" by 6" for equipment.
 4. Letter Size: Minimum 1/4 " for name of units if viewing distance is less than 24 inches, 1/2" 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.
 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- B. Access Panel and Door Markers: 1/16" thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8" holes for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ANSI/ASME A13.1, unless otherwise indicated.
 2. Type and Size of Letters: Comply with ANSI/ASME A13.1, unless otherwise indicated.
 3. Legends: Spelled out in full or commonly used and accepted abbreviations.
 4. Pipes with OD, Including Insulation, Less Than 6": Full-band pipe markers extending 360 degrees around pipe at each location.
 5. Pipes with OD, Including Insulation, 6" and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with ¼” letters for piping system abbreviation and ½” numbers, with numbering scheme to match existing numbering scheme on temperature control drawings. Provide 5/32” hole for fastener.
 - 1. Material: 3/32” thick laminated plastic with 2 black surfaces and white inner layer.
 - 2. Valve-Tag Fasteners: Brass beaded wire-link chain, beaded chain or S-hook.
 - 3. Valve tag size and shape: 1 ½” round.

2.5 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on temperature control drawings), location of valve (room or space), normal-operating position (open, closed, or modulating) and variations for identification. Mark valves for emergency shutoff and similar special uses.
- B. Valve-Schedule Frames: Glazed display frame for removable mounting on walls for each page of valve schedule. Include mounting screws.
- C. Frame: Extruded aluminum.
- D. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 EQUIPMENT LOCATORS ON CEILING

- A. Provide ¼” round colored dot stickers (as available at office supply stores) on ceiling grid for locating equipment and valves. Adhere stickers to the ceiling grid as close to each piece of equipment as possible. Colors shall be as follows.
 - 1. Zone/Isolation water valves Black
- B. Approval shall be obtained from Architect prior to applying dots.

PART 3 - EXECUTION

3.1 EQUIPMENT IDENTIFICATION

- A. Install equipment markers on or near each piece of plumbing equipment.
- B. All equipment shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.
- C. Locate equipment markers where accessible and visible. Include markers for the following general categories of equipment:
 - 1. Main control and operating valves including safety devices.
 - 2. Meters, gages, thermometers and similar units.
 - 3. Pumps.
 - 4. Water Heaters.

5. Strainers, filters, water-treatment systems and similar equipment.
- D. Install access panel markers with screws on equipment access panels.

3.2 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
- B. All piping shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.
- C. Locate pipe markers where accessible and visible.
 1. Pipes with OD, Including Insulation, Less Than 6": Pretensioned pipe markers. Use size to ensure a tight fit.
 2. Pipes with OD, Including Insulation, 6" and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
- D. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:
 1. Near each valve and control device
 2. Near each branch connection. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings and nonaccessible enclosures.
 4. At access doors 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 25' along each run.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.3 VALVE TAGS

- A. Install tags on valves and control devices in piping systems; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections. List tagged valves in a valve schedule.

END OF SECTION 220553

SECTION 220716 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the Plumbing insulation as specified and as indicated on the drawings

1.2 APPROVED MANUFACTURERS

- A. The basis for the fiberglass pipe insulation in this specification is Johns-Mansville and Certain-Teed which shall represent the minimum level of construction. Products manufactured by Owens-Corning and Knauf shall be permitted to bid these specifications.
- B. The basis for the plastic foam insulation in this specification is Armacell which shall represent the minimum level of construction. Products manufactured by Aeroflex USA and K-Flex shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 FIBERGLASS PIPE INSULATION

- A. The following lines shall be insulated with Certain-Teed preformed fiberglass pipe insulation with ASJ jacket material and SSL self sealing lap in thickness as scheduled:

1. INSULATION THICKNESS FOR PIPE SIZES

PIPING SYSTEM	PIPE SIZE	
	≤ 1½"	≥2"
Hot Water	1"	1"
Cold Water	1"	1"
Hot Water Recirculation	1"	1"
Roof Drains	1"	1"
Purified Water	1"	1"

- 2. Insulation thickness specified are based on a minimum of k=0.27. Increase thickness as required for a lesser K value.
- 3. Vapor barrier will be required only on cold water and roof drain lines. Vapor barrier shall be continuous throughout piping system with all openings sealed. Fitting insulation on pipe requiring same shall receive a 1 mil aluminum foil barrier sandwiched between two coats of #1C501 vapor barrier mastic.

4. Fittings, valve bodies, hangers, etc., shall be insulated with fiberglass wrap built up to adjacent insulation thickness, wired in place. Provide pre-formed PVC fitting covers on all fittings. Fittings shall carry a 25 or less flamespread and 50 or less smoke development rating.
5. All lines are to be hung from the exterior of the insulation. Preformed sheet-metal insulation shields shall be provided at all hangers. Provide inserts on line sizes specified below.

2.2 PLASTIC FOAM SHEET INSULATION

- A. The roof drain and overflow drain bowls shall be insulated with 3/4" thick Armacell "AP/Armaflex" closed-cell, elastomeric insulation. Products manufactured by Aeroflex USA and K-Flex shall be permitted to bid these specifications.
- B. Cut sheet goods in sections to accurately fit the equipment and shall be adhered to equipment and adjacent material with #520 adhesive applied in strict accordance with manufacturer's recommendations.

2.3 FLEXIBLE VINYL INSULATION

- A. Handicapped lavatory and sink P-traps and hot and cold water lines shall be insulated with Truebro Model 102, fully molded insulation system with 3-piece interlocking trap and 2-piece interlocking angle valve assembly. Color shall be light gray. Products manufactured by PROFLO and Dearborn shall be permitted to bid these specifications.
- B. Contractor shall refer to Architectural details to ensure all handicapped sinks and lavatories are insulated per ADA requirements.

2.4 PIPE INSULATION COVER

- A. All piping systems indicated to receive fiberglass insulation and located within mechanical rooms shall be provide with Ceel-Tite insulation cover. Insulation shall be covered with Ceel-Tite 130 preformed ABS insulation cover. Products manufactured by Proto and Express shall be permitted to bid these specifications.
- B. All piping systems indicated to receive fiberglass insulation and located exposed within areas with no finished ceiling shall be provide with Ceel-Tite insulation cover. Insulation shall be covered with Ceel-Tite 130 preformed ABS insulation cover. Products manufactured by Proto and Express shall be permitted to bid these specifications.

PART 3 - EXECUTION

3.1 PIPE INSULATION

- A. All insulated horizontal piping shall be supported from outside the insulation. Provide inserts and saddles as recommended by the insulation manufacturer.
- B. Unless otherwise indicated, all insulation shall be installed in accordance with the "Commercial & Industrial Insulation Standards", published by the Midwest Insulation Contractors Association.
- C. Insulation shall be applied on clean dry surfaces. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Riser clamps, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent

condensation. Unsatisfactory installations will be rejected and shall be removed and replaced. Insulation on cold surfaces shall be continuous through sleeves.

- D. Insulation inserts shall be installed at all hangers and supports that are external to the insulation. Inserts shall be “foam glass” or rigid foamed plastic. Pipe insert thickness shall be equal to the adjoining insulation. The length of inserts for each pipe size shall be as follows:

Pipe Size	Insulation Insert Length
3" to 6"	9" long

- E. Joints shall be butted firmly together. Longitudinal jacket laps and butt strips shall be smoothly secured with Benjamin Foster 82-07 adhesive, or equal. Products manufactured by Armacell and K-Flex shall be permitted to bid these specifications. Outward clinch staples shall be used on laps as required for insulation over heating lines only. All fiberglass insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere to facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723 not exceeding: Flame Spread 25 - Smoke Developed 50. Accessories, such as adhesives, mastics, cements, tapes and glass mesh cloth for fittings shall have the same component ratings as listed above. Hot piping fittings insulation shall be coated with Fosters 30-35 or equal. Cold fittings insulation shall be coated with 2 coats (reinforced with glass mesh) of Fosters 30-36 or equal. All products shall bear labels on their shipping cartons indicating that flame and smoke ratings do not exceed above requirements.
- F. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.
- G. Termination of all covering shall be as required to allow for pipe expansion without damage to covering and the ends of the covering shall be fitted with protector cups.
- H. Insulation on piping exposed to the weather, except foamed plastic, shall be covered with an aluminum cover secured with stainless steel bands, on 12" centers. Covers shall overlap a minimum of 2" at longitudinal and transverse joints. Longitudinal joints shall be installed on the bottom of the pipe. At the contractors option, insulation may be covered with Ceel-Tite 130 preformed ABS insulation cover with longitudinal seams on the bottom. All fittings shall be provided with Ceel-Tite 130 preformed fitting covers. Products manufactured by Proto and Express shall be permitted to bid these specifications.

END OF SECTION 220716

SECTION 221100 – DOMESTIC WATER PIPE AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the pipe and fittings as specified and indicated on the drawings.

1.2 QUALITY ASSURANCE

- A. Welders Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing.
- B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.
- C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Plumbing Refrigeration.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

PART 2 - PRODUCTS

2.1 ABOVE GRADE PIPING AND FITTINGS

- A. The following shall be acceptable piping methods for all potable domestic water lines 4" and smaller:
 - 1. Type L hard copper pipe with sweat type fittings and 95/5 solder or Silfos brazed connections.
 - 2. Type L hard copper pipe with copper and copper alloy fitting shall conforming to ASME B16.18 or B16.22 as well as IAPMO PS117 may be used. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed by fitting manufacturer. Press end shall have smart connect feature. Viega ProPress. Products manufactured by Mueller and NIBCO shall be permitted to bid these specifications.
 - 3. Type L hard copper with push-to-connect fittings may be used. Fittings shall be wrought copper or cast bronze with EPDM seals and 301 stainless steel internal components. Victaulic PermaLynx. Products manufactured by Mueller and Apollo shall be permitted to bid these specifications.
 - 4. Copper-tube dimensioned grooved joint fittings conforming to ASME B16.18 or B16.22, with Installation-Ready couplings suitable for direct stab installation without field disassembly. Victaulic Copper-Connection with Style 607 Quick-Vic Couplings. Products manufactured by Mueller and Apollo shall be permitted to bid these specifications.

2.2 BELOW GRADE PIPE AND FITTINGS

- A. Type K hard copper piping with silfos joints shall be used for all potable and domestic water piping below building slabs, including domestic service entrance lines 3" and smaller.
- B. ANSI Class 50 and 51 cement lined ductile iron pipe, or C900 plastic, with mechanical joints shall be used for the domestic water service lines 4" and larger.

PART 3 - EXECUTION

3.1 DOMESTIC WATER LINES

- A. All runs of pipe shall be installed as shown on drawings, unless some condition should arise which would make it necessary or seem advisable to alter same; in which case, the architect or his representative must be consulted before making any change. No piping shall be buried unless shown as such as the drawings.
- B. Exterior buried piping shall have a minimum of 42" cover.
- C. Air chambers shall be provided on all water supplies near each faucet control valve or flush valve, except hose bibbs. Air chamber shall be equal in length to at least 12 diameters of the pipe.
- D. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

3.2 EXPOSED AND CONCEALED PIPING

- A. All piping shall be concealed in walls, below floors, or above ceilings unless indicated otherwise or shown running through areas with exposed structure. All pipe shall be installed parallel or perpendicular to building surfaces.

END OF SECTION 221100

SECTION 221110 – DOMESTIC WATER PEX PIPING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cross-Linked Polyethylene (PEX) Plastic Tubing and Fittings for Hot and Cold Water Distribution Systems

1.2 RELATED SECTIONS

- A. Section 221100 Domestic Water Pipe and Fittings

1.3 REFERENCES

- A. ASTM F876/F2023 - Specification for Cross-linked Polyethylene (PEX) Tubing
- B. ASTM F877 - Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems
- C. CSA-B137.5 Cross-Linked Polyethylene (PEX) Tubing Systems for Pressure Applications
- D. NSF 14 - Plastic Piping Components and Related Materials
- E. NSF 61 - Drinking Water System Components - Health Effects
- F. AWWA C651 Standard for Disinfecting Water Mains
- G. ICC International Plumbing Code

1.4 SYSTEM DESCRIPTION

- A. Cross-linked polyethylene plastic tubing and fittings shall be acceptable for use in hot and cold water distribution systems. The systems are for the transport of potable water as part of the building plumbing.

1.5 QUALITY ASSURANCE

- A. Pipe Standards: Cross-Linked Polyethylene (PEX) plastic tubing shall conform to ASTM F876/ F2023, ASTM F877, or CSA CAN/CSA-B137.5.
- B. Fitting Standards: Cross-Linked Polyethylene (PEX) press connect fittings shall conform to ASTM F877.
- C. Installer Qualifications: The installer shall be a qualified plumber, and familiar with the installation of PEX piping systems.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. The cross-linked polyethylene plastic tubing shall be shipped to the job site on truck or in such a manner to protect the tubing. The cross-linked polyethylene fittings and manifolds shall not be rough handled during shipment. The tubing and fittings shall be unloaded with reasonable care.

- B. Cross-linked polyethylene plastic tubing and fittings shall be stored in a flat, dry, well ventilated location, not exposed to direct sunlight. Normal care in handling shall be exercised to avoid abuse of the tubing. The tubing and fittings shall not be thrown or dropped on the ground, walked on, or dragged.

1.7 PROJECT CONDITIONS

- A. The location of the manifold shall be accessible in an area not subject to freezing. Proper support of the manifold shall be provided.

1.8 WARRANTY

- A. The tubing and fittings manufacturer shall warrant that the tubing and fittings are free from defects and conform to the designated standard. The warranty shall only be applicable to tubing and fittings installed in accordance with the manufacturer's installation instructions.
- B. The manufacturer of the tubing and fittings shall not be responsible for the improper use, handling, or installation of the product

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. PureFlow Water System: Manufactured by Stadler / Viega, 3 Alfred Circle, Bedford, MA 01730, 800-370-3122
- B. Uponor, Inc.
- C. Zurn

2.2 MATERIALS

- A. FostaPex Tubing: High-Density Cross-linked polyethylene tubing shall be manufactured from polyethylene compounds that are electronically crosslinked. The degree of crosslinking shall be at a minimum of 65 percent. Cross-linked polyethylene plastic tubing (PEXc) shall be rated for maximum pressure of 100 psi at 180°F or 80 psi at 200°F. Cross-linked polyethylene plastic tubing shall be opaque in color to reduce transmission of visible light. Inner layer shall be fully dimensioned Pexcel tubing conforming to ASTM F876 standards.
- B. Press Fittings: Cross-linked polyethylene fittings shall be manufactured from bronze. The press sleeve shall be stainless steel. The press sleeve shall have a sight hole to ensure proper insertion.
- C. Manifolds: Acceptable manifolds shall include:
 - 1. Bronze Manifolds: Shall be bronze material having 1 inch NPT threaded ends. Manifolds shall be nondirectional. All outlets shall either be ProPress or Press fittings. Shall be provided by the Cross-linked polyethylene manufacturer.
 - 2. Copper Manifolds: Shall be copper material having a female solder or ProPress inlet. All outlets shall be Press or ProPress fittings. Shall be provided by the Cross-linked polyethylene system manufacturer.
 - 3. Adapter Fittings: Cross-linked polyethylene adapter fittings shall conform to ASTM F877

or CSA CAN3-B137.5. The adapter fittings shall mate to NPT threads, copper tubing, copper fitting or ProPress fittings.

2.3 ACCESSORIES

- A. Hangers and support systems: Hangers and supports shall be designed for cross-linked polyethylene plastic tubing. The hangers and supports shall not have sharp edges or surfaces that can cut the tubing. Acceptable hangers include plastic u-clip tubing fasteners, suspension clip tubing fasteners, nylon clips, u channel fasteners and other hangers specifically designed for cross-linked polyethylene plastic tubing. Acceptable supports include drop ear bend supports, snap-in bend supports, plastic bend supports, plastic bend supports for slab and other supports specifically designed for cross-linked polyethylene plastic tubing.
- B. Penetration Protection: Penetrations of fire resistance rated walls, floors, or ceilings by cross-linked polyethylene plastic tubing shall be protected in accordance with the requirements of the building code.

2.4 SOURCE QUALITY CONTROL

- A. The cross-linked polyethylene plastic tubing and fitting manufacturer shall maintain a third party listing of the tubing and fittings. The tubing and fittings shall be certified in accordance with NSF 61 to verify suitability to transport potable water. The tubing and fittings shall have the mark “NSF-pw” or “NSF 61” permanently marked on the product to verify the material listing.
- B. The manufacturer of the cross-linked polyethylene tubing and fittings shall maintain a quality control program in accordance with ISO 9001 in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard. The tubing and fittings shall be certified as complying with NSF 14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installing contractor shall carefully examine the cross-linked polyethylene plastic tubing for defects, cuts, abrasions, cracks, fading color, or blemishes. There shall be no cracks or heavy deformations of the tubing. Fittings and manifolds shall be checked for any signs of abuse. Any damaged tubing or fittings shall be rejected.

3.2 PREPARATION

- A. Pexcel Tubing: Cross-linked polyethylene plastic tubing shall be cut with a cross-linked polyethylene tubing cutter. The tubing shall be cut square to permit proper joining with the tubing fitting.
- B. FostaPex Tubing: Cross-linked polyethylene plastic tubing shall be cut with a cross-linked polyethylenetubing cutter. The tubing shall be cut square to permit proper joining with the tubing fitting. Outer layers shall be removed via prep tool leaving inner cross-linked polyethylene plastic tubing to accept stainless sleeve. Prep tool shall have an internal stop to ensure proper length of exposed inner cross-linked polyethylene plastic tubing.

3.3 INSTALLATION

- A. Tubing Connection: All tubing connections shall be made strictly per the manufacturers

recommendations.

- B. **Connection to Other Materials:** Connections between cross-linked polyethylene plastic tubing and other piping materials shall be by use of approved adapter fittings. Adapter fittings shall be connected by NPT threads, copper tubing, copper fitting or ProPress fittings. The adapter fittings shall be installed in accordance with the manufacturer's installation instructions.
- C. **Expansion and Contraction:** Provision shall be taken for the expansion and contraction of the crosslinked polyethylene plastic tubing installation. The tubing shall not be installed in tight straight runs. Flexibility in the installation shall be provided to permit expansion and contraction.
- D. **Hangers and Supports:** Cross-linked polyethylene plastic tubing shall be horizontally supported at 32 inch intervals. The tubing shall be vertically supported at 4 foot intervals.
- E. **Pipe Protection:** Cross-linked polyethylene plastic tubing shall be installed in a workmanlike manner to avoid damage to the tubing and surrounding building systems. Cross-linked polyethylene plastic tubing shall be protected to avoid abrasion and contact with the surrounding building material.
- F. **Penetration Protection:** Every penetration of floors, ceilings, and walls with cross-linked polyethylene plastic tubing must be protected against flame and fire penetration in accordance with the building and fire codes.
- G. **Connection to Fixtures:** Plumbing fixtures shall connect to the cross-linked polyethylene plastic tubing either directly with an adapter fitting or with flexible tubing connectors. Each fixture water supply shall have a supply stop to isolate the connection to the fixture. The fixture shut off shall be permitted to be a stop at the manifold.
- H. **Piping Identification:** Cross-linked polyethylene plastic piping systems for hot and cold water distribution shall have the markings that conform to the ASTM F876 marking requirements and also include: NSF-pw, ES ER 5944 ES ER 5945 ES ER 5421.
- I. **Routing of Pipe:** Cross-linked polyethylene plastic tubing shall be kept a minimum of 6 inches horizontally and 12 inches vertically from any sources of heat such as recessed lights and appliance or heater vents.
- J. **Manifold Installation:** Install manifolds in accordance with the manufacturer's installation instructions.
 - 1. **Bronze Manifolds:** Install the manifold in an accessible location. Adequate room shall be provided around the manifold to permit installation of the cross-linked polyethylene tubing. Use manifold brackets provided with the manifold from the manifold manufacturer.
 - 2. **Copper Manifolds:** Shall be used where permanent connections must be used. Copper manifold shall be used in concealed locations. May be fastened using any standard fasteners for 1" copper.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of a section or of the entire hot and cold water supply system, it shall be tested and proved tight under a water pressure not less than the working pressure under which it is to be used. The water used for tests shall be obtained from a potable source of supply. The piping shall withstand the test without leaking for a period of not less than 15 minutes.

3.5 CLEANING

- A. Disinfection: The cross-linked polyethylene plastic piping hot and cold water distribution system shall be disinfected prior to being placed in service. The system shall be disinfected in accordance with Section 220550.

END OF SECTION 221110

SECTION 221119 – DOMESTIC WATER SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the domestic water specialties as specified and indicated on the drawings.

1.2 APPROVED MANUFACTURERS

- A. The basis for the backflow prevention devices in this specification is Febco and Watts and shall represent the minimum level of construction. Products manufactured by Stiebel Eltron shall be permitted to bid these specifications.
- B. The basis for the tempering valves in this specification is Leonard and shall represent the minimum level of construction. Equipment from Symons or Powers shall be permitted to bid these specifications.
- C. The basis for other specialty items in this specification are those manufactures listed. Alternative manufactures of equivalent products will be allow to bid if approved.

PART 2 - PRODUCTS

2.1 REDUCED PRESSURE STYLE BACKFLOW PREVENTER – ¾” TO 2”

- A. Provide Febco 825Y reduced pressure backflow preventer where indicated at hydronic system make-up connections and domestic water service entrance. Alternate manufacturers: Apollo Valves, MIFAB, Watts.
- B. Reduced pressure backflow preventer assemblies shall consist of two independent "Y" configured check valves and one differential relief valve.
- C. By design, the assembly shall automatically reduce the pressure in the zone between the checkvalves. Should the differential between the zone and upstream pressure drop to 2 psi, the differential relief valve will open, maintaining proper zone differential.
- D. All internal metal parts included in the check assemblies shall be bronze and shall not contain any dissimilar metals. Elastomeric seat discs on the checks and relief valve must be reversible, and seat rings shall be B-61 bronze. The check assembly shall be center stem guided at the seat ring and at the cover by replaceable non-corrosive bushings. Relief valve spring is to be Series 300 stainless steel.
- E. Head losses through the assembly shall not exceed 12.5 psi at velocities from zero up to and including 7.5 FPS.
- F. Valve bodies and caps including relief valve body and cover shall be bronze.
- G. Reduced pressure backflow preventer assemblies including shutoff valves and test cocks shall be full ported ball valves. Assemblies must be factory assembled and backflow tested.
- H. The assembly shall be constructed so that check valve and relief valve components may be serviced without removing the valve body from the line. All seat discs shall be reversible. The assembly shall be rated 175 MWWP (32 degrees F. to 140 degrees F.).
- I. Relief valve assembly shall be of a modular design for ease of maintenance.

- J. The assembly shall meet or exceed requirements of ASSE Standard 1013, AWWA Standard C511, CSA Standard B64.4 and the USC Foundation for Cross Connection Control and Hydraulic Research.

2.2 DOUBLE CHECK STYLE BACKFLOW PREVENTERS – ½” TO 10”

- A. Provide Febco 850, or approved equal, double check valve assembly where indicated to create potable and non-potable water systems in hydronic system make-up connections. Alternate manufacturers: Apollo Valves, MIFAB, Watts.
- B. The double check valve assembly 3/4" through 2", shall consist of a bronze body with bronze caps. The body shall be a "Y" pattern design incorporating two spring loaded, center guided check assemblies. The assembly shall include threaded inlet and outlet, full port ball valve shut-off valves and four ball valve test cocks. All internal parts shall be of corrosion resistant materials.
- C. Double check valves shall be constructed so all internal parts can be serviced without removing the assembly from the line. Seat discs shall be reversible. The assembly shall operate when installed in any position. Double check valves shall be rated to 175 psi water working pressure and water temperature from 32° F to 140° F.
- D. The assembly shall meet the requirements of ASSE Standard 1015, AWWA Standard C506-78, and USC Foundation for Cross Connection Control and Hydraulic Research, Sixth Edition.

2.3 PRESSURE REDUCING VALVES

- A. Provide two Watts, Amtrol, or approved equal Cash Acme, water pressure reducing valves in parallel.
- B. Pressure reducing valves shall be model #223 and rated as listed below with a maximum 15 psi fall off pressure.
 - 1. PRV-1 shall be #223- 2” rated for 100 gpm and set for 75 psi

2.4 HOSE BIBBS

- A. Provide Woodford, or approved equal Zurn, Prier, Wade, Smith, or Josam hose bibbs as follows:
 - 1. Exterior: Woodford #65C (self-draining with vacuum breaker).
 - 2. Interior: Zurn S-1333 key operated, vandal resistant interior hose bibb with vacuum breaker.

2.5 SHOCK STOPS

- A. Provide Precision Plumbing Products, Watts, Oatey, or approved equal, Model SC water hammer arrestors sizes as noted on the plans and required by the plumbing code.

END OF SECTION 221119

SECTION 221300 – SANITARY PIPE AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the pipe and fittings as specified and indicated on the drawings.

1.2 APPROVED MANUFACTURERS

- A. The basis for the equipment in this specification is Charlotte Pipe and shall represent the minimum level of construction. Equipment from ABI and Tyler Pipe shall be permitted to bid these specifications

1.3 SHOP DRAWINGS

- A. Shop drawings shall be submitted as specified in Division 1.
- B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the material in accordance with the latest adopted version of CISPI Standard 301 or ASTM A888 or ASTM A74.

PART 2 - PRODUCTS

2.1 ABOVE GRADE PIPING AND FITTINGS

- A. Where allowable by Local Codes, SDR 21 drain waste and vent piping with solvent welded joints shall be used for all soil, waste and vents lines located below and outside of the building slab. All changes in directions shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow are from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation
- B. Service weight centrifugally cast iron soil pipe, bearing the mark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International, with "NO-HUB" joints shall be used for soil, waste and vent lines. All changes in direction shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow is from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation.
- C. Couplings for joining hubless cast iron pipe and fittings conforming to ASTM Q-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal sizes 5 to 10 inch diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to FM standard 1680, Class 1, or ASTM C-1540 and shall be manufactured by Clamp-All Products Model Hi-Torq 125 and Hi-Torq 80, or equal Husky Technologies Model SD-4000.
- D. Galvanized pipe shall be used from the tapped sanitary tee through wall to fountain and sink trap connections.

2.2 BELOW GRADE PIPE AND FITTINGS

- A. Service weight centrifugally cast iron soil pipe, bearing the mark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International, with "TY-SEAL" joints shall be used for soil, waste and vent lines. All changes in direction shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow is from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation. Service weight centrifugally cast iron soil pipe, bearing the mark of the Cast Iron Institute, with "NO-HUB" joints shall be used for soil, waste, vent, and roof drain lines only when provided with couplings conforming to ASTM Q-888, shall be 3 inches wide for nominal pipe sizes 1 ½ to 4 inches in diameter, 4 inches wide for nominal sizes 5 to 10 inch diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .024 inches, (24 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 125 in/lbs. Sealing gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to FM standard 1680, Class 1, or ASTM C-1540.
- B. Where allowable by Local Codes, SDR 21 drain waste and vent piping with solvent welded joints shall be used for all soil, waste and vents lines located below and outside of the building slab. All changes in directions shall be made by the use of 45 wyes, half wyes, long sweep 1/4 bends, 1/6, 1/8, or 1/16 bends. Sanitary tees may be used where the changes in direction of flow are from horizontal to vertical. Where space conditions necessitate the use of short radius fitting, approval shall be obtained before installation

PART 3 - EXECUTION

3.1 SOIL, WASTE AND VENT LINES

- A. The arrangement of the systems must be as direct as possible avoiding all unnecessary offsets. All pipe shall run as indicated on the drawings, unless some condition should arise which would make it necessary or seem advisable to alter same; in which case, the Architect or his representative must be consulted before making any change. Horizontal lines shall be graded at 1/8" per foot, unless noted otherwise. Where necessary, lines may pitch at 1/10" per foot when approved or noted.
- B. Every vent for traps shall be connected to the waste line by as short a connection as possible, but in no case shall such connections have a length greater than 2' in length, measuring horizontally from the center of the fixture to the vent. Horizontal vents shall connect into the main stack at least 18" above the highest fixture.
- C. Each fixture and piece of equipment requiring connection to the sanitary drainage system shall be equipped with a trap. Each trap shall be placed as near the fixture as possible and no fixture shall be double-trapped.
- D. All piping shall be installed in strict compliance with all adopted building codes as well as manufacturer's recommendations.

3.2 EXPOSED AND CONCEALED PIPING

- A. All piping shall be concealed in walls, below floors, or above ceilings unless indicated otherwise or shown running through areas with exposed structure.
- B. All pipe shall be installed parallel or perpendicular to building surfaces.

END OF SECTION 221300

SECTION 221319 - SANITARY SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the sanitary system specialties as specified and indicated on the drawings.

1.2 APPROVED MANUFACTURERS

- A. The basis for the cleanouts and drains in this specification is Zurn and shall represent the minimum level of construction. Products manufactured by Smith, Wade, Josam, Watts Drainage, and Stiebel Eltron shall be permitted to bid these specifications

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Provide Zurn, or approved equal, cleanouts where shown. Cleanouts shall be the same size pipe for pipe 4" and smaller, and 4" for lines 4" and larger.
- B. Cleanouts shall be as follows:
 - 1. Floor and exterior cleanouts shall be Zurn ZN-1400-HD. Set in 24" x 24" x 4" concrete pad for exterior use.
 - 2. Wall cleanouts shall be "NO-HUB" caps behind Zurn ZANB-1460, 10 x 10 nickel bronze with polished top.
- C. Cleanouts shall be provided with carpet covers where applicable.

2.2 FLOOR DRAINS

- A. Floor drains shall be Zurn, Josam, MIFAB with deep seal trap and shall be as scheduled on the drawings.
- B. Trap material shall match that of system connection.
- C. Unless noted otherwise, or specifically excluded by code, provide Sure Seal, Green Drains, MIFAB, inline floor drain trap seal having ASSE 1072 approved listing. Products not having the ASSE 1072 approved listing will not be accepted.

2.3 FLOOR SINKS

- A. Floor sinks shall be Zurn, Josam, MIFAB with deep seal trap and shall be as scheduled on the plans.
- B. Trap material shall match that of system connection.
- C. Unless noted otherwise, or specifically excluded by code, provide Sure Seal, Green Drains, MIFAB, inline floor drain trap seal having ASSE 1072 approved listing. Products not having the ASSE 1072 approved listing will not be accepted.

2.4 BACKWATER VALVES

- A. Provide Zurn model Z-1091 backwater valve with dura-coated cast iron body, hub inlet and open outlet for installation at end of drainage line. Provide with automatic type valve seat which hangs closed during periods of non-operation. Alternate manufacturers: Jay R. Smith, Smith.

PART 3 - EXECUTION

3.1 CLEANOUTS

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs, and all locations required by the local utility and AHJ.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets, and where required by the adopted plumbing code.
- H. Downspout Nozzles: Where internal surface of visible piping behind downspout nozzle is not black, contractor shall paint visible surfaces matte black.

END OF SECTION 221319

SECTION 223300 – ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide water heating equipment as specified and as indicated on the drawings.

1.2 APPROVED MANUFACTURERS

- A. The basis for the water heating equipment in this specification is A.O. Smith and shall represent the minimum level of construction. Equipment from Rheem or State shall be permitted to bid these specifications

1.3 SHOP DRAWINGS

- A. Shop drawings shall be submitted as specified in Division 1.
- B. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
 - 2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
 - 3. Dimensional drawings showing layout, connection points, and detailed layout of components.
 - 4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.

PART 2 - PRODUCTS

2.1 WATER HEATER - NORMAL ELECTRIC

- A. Provide with non-simultaneous, single or three phase element, and glass lined storage tank. Alternate manufacturers: Rheem, Bradford White, State.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. All aspects of the installation of the water heaters shall be in strict accordance with the manufacturer's instructions. All materials used shall conform to manufacturer's recommendations.

END OF SECTION 223300

SECTION 224200 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide complete, all fixtures indicated. All fixtures shall be set firm and true, connected to all pipe and ready for use. All fixtures shall be of one manufacturer throughout the entire installation, unless otherwise specified.
- B. Quarter Turn Stop valves shall be provided on the hot and cold water connections to all plumbing fixtures. No flexible supply connections are allowed.
- C. Refer to elevation on Architect's drawings for installation height of wall-mounted fixtures.

1.2 APPROVED MANUFACTURERS

- A. The basis for the fixtures in this specification are those named and shall represent the minimum level of construction. Fixtures from Eljer, American-Standard, Crane, and Kohler shall be permitted to bid these specifications
- B. The basis for the fixture carriers in this specification is Zurn and shall represent the minimum level of construction. Products manufactured by Smith, Wade, Josam, Watts Drainage, and Stiebel Eltron shall be permitted to bid these specifications

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of ANSI Standard A117.1, "Buildings and Facilities -- Providing Accessibility and Useability for Physically Handicapped People," and Public Law 90-480, "Architectural Barriers Act, 1968," with respect to plumbing fixtures for the physically handicapped.
- B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1. The terms "listed" and "labeled" shall be as defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. Burden of proof for equality of plumbing fixtures is on the proposer.

1.4 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below matching products

installed, packaged with protective covering for storage, and identified with labels clearly describing contents.

- B. Faucet Washers and O-rings: Furnish quantity of identical units not less than 10 percent of amount of each installed.
- C. Faucet Cartridges and O-rings: Furnish quantity of identical units not less than 5 percent of amount of each installed.
- D. Flushometer Repair Kits: Furnish quantity of identical units not less than 10 percent of amount of each flushometer installed.
- E. Provide a hinged-top wood or metal box, or individual metal boxes, having a separate compartment for each type and size of above extra materials.
- F. Water Closet Tank Repair Kits: Furnish quantity of identical flush valve units not less than 5 percent of amount of each type installed.
- G. Toilet Seats: Furnish quantity of identical units not less than 5 percent of amount of each type toilet seat installed.
- H. Filter Cartridges: Furnish quantity of identical filter cartridges not less than 50 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Fixtures shall be as scheduled on the drawings.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products in each category, by one of the following listed for that category:
 - 1. Water Closets:
 - a. American Standard, Inc.
 - b. Crane Plumbing/Fiat Products.
 - c. Eljer; A Household International Co.
 - d. Gerber Plumbing Fixture Corp.
 - e. Kohler Co.
 - f. Sloan
 - g. Toto
 - 2. Lavatories:

- a. Acorn Engineering Co.
 - b. American Standard, Inc.
 - c. Crane Plumbing/Fiat Products.
 - d. Eljer; A Household International Co.
 - e. Gerber Plumbing Fixture Corp.
 - f. Just Manufacturing Co.
 - g. Sloan
 - h. Kohler Co.
3. Drinking Fountains:
- a. American Standard, Inc.
 - b. Crane Plumbing/Fiat Products.
 - c. Eljer; A Household International Co.
 - d. Filtrine Manufacturing Co.
 - e. Halsey Taylor; A Household International Co.
 - f. Haws Drinking Faucet Co.
 - g. Kohler Co.
4. Emergency Equipment:
- a. Bradley Corp.
 - b. Guardian Equipment.
 - c. Haws Drinking Faucet Co.
5. Toilet Seats:
- a. Bemis Mfg. Co.
 - b. Beneke Div.; Sanderson Plumbing Products, Inc.
 - c. Church Seat Co.
 - d. Olsonite Corp.
6. Flushometers:
- a. Cambridge Brass Div.; EMCO Products; Masco Corp.

- b. Gerber Plumbing Fixture Corp.
 - c. Sloan Valve Co.
 - d. Zurn Industries, Inc.; Flush Valve Operations.
7. Commercial/Industrial Faucets:
- a. American Standard, Inc.
 - b. Chicago Faucet Co.
 - c. Crane Plumbing/Fiat Products.
 - d. Eljer; A Household International Co.
 - e. Grohe America, Inc.
 - f. Kohler Co.
 - g. Royal Brass Mfg. Co.
 - h. T & S Brass and Bronze Works, Inc.
8. Shower Receptors:
- a. Aqua Glass Corp.
 - b. Crane Plumbing/Fiat Products.
 - c. Florestone Products Co., Inc.
 - d. Stern-Williams Co., Inc.
9. Sensor-Operated Faucets and Devices:
- a. Acorn Engineering Co.
 - b. Bradley Corp.
 - c. Sloan Valve Co.
10. Supports:
- a. Josam Co.
 - b. Smith (Jay R.) Mfg. Co.
 - c. Wade Div.; Tyler Pipe
 - d. Watts Drainage
 - e. Zurn Industries, Inc.; Hydromechanics Div.

2.3 FAUCETS

- A. Faucets General: Unless otherwise specified, provide faucets that are cast brass with polished chrome-plated finish.

2.4 FLUSHOMETERS

- A. Provide flushometers compatible with fixtures, with features and of consumption indicated.
- B. Construction: Cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, vacuum breaker, and brass lever handle actuation except where other variations are specified. Type shall be diaphragm operation except where other type is specified.
- C. Finish: Exposed metal parts shall be polished chrome-plated, except components installed in a concealed location may be rough brass or unfinished.

PART 3 - EXECUTION

3.1 PLUMBING FIXTURES

- A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings and in complete compliance with the manufacturer's recommendations and instructions.
- B. Refer to elevations on the Architect's drawings for installation height of wall-mounted fixtures.
- C. Refer to architectural plans to ensure flush valve control handle is mounted for use from the wide side of handicapped toilet stalls.
- D. Set shower receptors and mop basins in leveling bed of cement grout.
- E. Install stop valve in an accessible location in each water supply to each fixture.
- F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
- G. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.
- H. Operate and adjust all plumbing fixtures and equipment. Replace damaged and malfunctioning fixtures, fittings, and controls.
- I. Adjust water pressure at drinking fountains, electric water coolers, and faucets, shower valves, and flushometers having controls, to provide proper flow and stream.
- J. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

END OF SECTION 224200

SECTION 230100 - GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1) and Section 260113 - Electrical Connections, apply to the work specified in DIVISION 23 - HVAC

1.2 DESCRIPTION OF WORK

- A. The Mechanical Contract includes all labor, materials and equipment required for the complete mechanical systems as shown and herein specified.
- B. Provide all devices and accessories as necessary for complete and working systems.
- C. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.
- D. The contractors shall become familiar with the work of all other trades and shall fully coordinate their work prior to ordering equipment or installation of systems.
- E. The Contractor shall coordinate his work with that of all other trades in order to eliminate interferences. He shall examine the drawings in advance to determine the location of sprinklers, electrical systems, ducts, piping, structures, conduits, alarms, and other equipment and services to be installed, and properly coordinate the installation of his work to avoid interferences. The Engineers have considered existing interferences in making the drawings, but it is the responsibility of the Contractor to include in his bid proposal adequate allowances to modify, offset, or otherwise accommodate all equipment to the structure, utilities, and apparatus.

1.3 QUALITY ASSURANCE

- A. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.
- B. All equipment of one type (such as fans, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.
- C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.
- D. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 SHOP DRAWINGS AND SUBMITTALS

- A. Shop drawings shall be submitted as specified in Section 013300 Submittals. Product data shall be submitted for all materials and equipment specified in DIVISION 23

1.5 PROJECT SEQUENCING

- A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.
- B. All temporary valves, dampers, etc. not indicated, but required by phasing, shall be included in the base bid.

1.6 HVAC DESIGN CONDITIONS

- A. Winter:
 - 1. Outdoor: -10° F.
 - 2. Indoor: 75° F.
- B. Summer:
 - 1. Outdoor: 96° F. DB and 77° F. WB
 - 2. Indoor: 75° F. DB and 64° F. WB

1.7 SUBSTITUTIONS

- A. Refer to Section 006325 – Product Substitution Request.

1.8 DEFINITIONS

- A. Furnish: The term “furnish” is used to mean “supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.”
- B. Install: The term “install” is used to describe operations at the project site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”
- C. Provide: The term “provide” means “to furnish and install, complete and ready for the intended use.”

1.9 RECORD DRAWINGS

- A. During the progress of the work of this section, this Contractor shall maintain an accurate record of all changes made in the installation of the system(s). Upon completion of the work, accurately transfer all record information in AutoCAD format. Provide final record on CR-ROM and three plotted sets. Insert one set into each of the operation and maintenance manuals described below.

1.10 OPERATION AND MAINTENANCE MANUALS

- A. Before project close-out, submit three copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.
- B. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing he has received the same.
- C. At the completion of the project furnish to the Architect for the Owner, three (3) copies of brochures in three ring notebook form, divided and tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local

contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.11 CODES AND ORDINANCES

- A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.
- C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.12 OWNER TRAINING

- A. Refer to Section 017900.

1.13 WARRANTY

- A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.
- B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.
- B. Capacities of equipment and materials shall not be less than those indicated.
- C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.
- D. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.
- E. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.2 EQUAL PRODUCTS OF LISTED MANUFACTURERS

- A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for

comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

- B. Where other manufacturer's names are listed, they are considered an acceptable manufacturer for the product specified.
- C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical, electrical, structural, or architectural requirements as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.
- B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, piping, ducts, conduit, air devices, or squeaks in rotating equipment will not be acceptable.
- C. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.
- D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.
- E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.
- F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.
- G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.
- H. It is the contractor's responsibility to provide materials and trim which properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.
- I. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

3.2 CONNECTIONS TO BUILDING STRUCTURE

- A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.
- B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.3 CLEANING

- A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.4 VISIT TO THE SITE

- A. Before submitting his bid, the Contractor shall visit the location of the job and shall fully understand the scope of the work to be done and the conditions under which it is to be performed. In no case shall additional compensation be granted when existing conditions could reasonably be determined.

3.5 EXISTING UTILITIES

- A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.
- B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.
- C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.
- D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

END OF SECTION 230100

SECTION 230513 - ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The contractors responsible for Division 23 work shall coordinate with the Electrical Contractor to insure motor starters of the proper size are furnished. Further, the Mechanical Contractor shall furnish all electric control items indicated to the Electrical Contractor for installation and connection.
- B. Refer to Section 260113 - ELECTRICAL CONNECTIONS for required electrical connections.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

- A. The Electrical Contractor shall provide all motor starters required for equipment provided in the mechanical contract that is not integral with equipment.

PART 3 - EXECUTION

3.1 MOTOR STARTERS

- A. The Mechanical Contractor shall coordinate all motor starters type and size with the Electrical Contractor to insure compatibility with the motors provided in this contract.

ITEM	Furnished By	Set By	Power Wiring	Control Wiring
Equipment motors	MC	MC	EC	---
Motor control centers	EC	EC	EC	TC
Factory furnished motor starters, contactors and disconnects	MC	MC	EC	TC
Loose motor starters, disconnect switches, thermal overloads and heaters.	EC	EC	EC	TC
Manual operating multi-speed switches	MC	EC	EC	TC
Control relays and transformers	TC	TC	EC	TC
Thermostats (low voltage)	TC	TC	---	TC
Thermostats (line voltage)	MC	EC	EC	---
Temperature control panels	TC	TC	EC	TC
Automatic damper operators (low voltage)	TC	TC	---	TC

Automatic damper operators (line voltage)	MC	EC	EC	---
Factory furnished variable frequency drives	MC	MC	EC	TC
Loose variable frequency drives	EC	EC	EC	TC
Motor and solenoid operated valves, low voltage	MC	MC	TC	TC
Motor and solenoid operated valves, line voltage	MC	MC	EC	EC
Smoke dampers and combination fire / smoke dampers	MC	MC	EC	EC
Duct smoke detectors	EC	MC	EC	EC
Refrigeration equipment and controls	MC	MC	EC	TC
Pushbutton stations and connections	MC	MC	EC	TC
Interlocks between cooling tower or evaporative cooler and water treatment pumps	---	---	---	MC
Interlocks between basin heater for cooling tower or evaporative cooler and sump temperature sensor	---	---	---	MC
Interlocks between chiller control panel and pump(s)	---	---	---	EC
Interlocks between kitchen exhaust hood(s) and make-up air unit(s)	---	---	EC	EC

MC = Mechanical Contractor

TC = Temperature Control Contractor – when there is not a separate TC, all items marked thus shall be performed by the MC.

EC = Electrical Contractor

END OF SECTION 230513

SECTION 230515 - HVAC RELATED WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The following is the work required by the General Contractor to facilitate the work of the Mechanical Contractor.
 - 1. Openings and chases.
- B. The following is the work required by the Mechanical Contractor to facilitate the work of his Contract.
 - 1. Cutting and patching.
 - 2. Excavation and backfilling.
 - 3. Pipe sleeves.

1.2 RELATED DOCUMENTS

- A. Refer to Section 312000 – Earth Moving for backfilling requirements.
- B. Unless otherwise addressed in the specification, as a minimum, backfill in 6” lifts, compacting to a minimum of 95% proctor. The first 12” of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 GENERAL CONTRACTOR'S WORK

- A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Mechanical Contractor and to refinish around same. The Mechanical Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.2 MECHANICAL CONTRACTOR'S WORK

- A. The Mechanical Contractor shall be responsible for locating and setting his own pipe sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.
- B. The Mechanical Contractor shall be responsible for cutting his own holes in existing construction and for patching and finishing around same, unless noted otherwise, to the satisfaction of the Architect. Any holes left in walls when existing pipe is removed by this Contractor shall be patched and finished by this Contractor.
- C. The Mechanical Contractor shall do all excavating and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed or braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent. The bottoms of trenches shall be tamped hard and graded to secure the required fall before laying pipe. Bell holes shall be excavated

so the pipe will rest on solid ground for its entire length.

- D. Hand backfill and tamp backfill into place at sides of pipes, leaving tops and joints exposed until pipe runs have been tested and approved.
- E. All sidewalks, streets, or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

END OF SECTION 230515

SECTION 230553 - HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide HVAC identification as specified and indicated on the drawings.
- B. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment markers
 - 2. Access panel and door markers
 - 3. Pipe markers
 - 4. Duct markers
 - 5. Valve tags
 - 6. Valve schedules

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve Schedules: Provide valve numbering scheme and identification type for each piping system. Furnish extra copies (in addition to mounted copies) to include in Operation and Maintenance Manuals.

1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of insulation and jacketing surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
 - 1. Seton
 - 2. Brady
 - 3. Craftmark
 - 4. Brimar Industries, Inc.

2.2 EQUIPMENT IDENTIFICATION DEVICES

- B. All equipment shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.
- C. Locate equipment markers where accessible and visible. Include markers for the following general categories of equipment:
 - 1. Fans, blowers, primary balancing dampers and mixing boxes.
- D. Install access panel markers with screws on equipment access panels.

3.2 DUCT IDENTIFICATION

- A. Install manufactured duct markers indicating service on each duct system. Install with flow indication arrows showing direction of flow.
- B. All ductwork shall be labeled as directed by the owner or as designated on the drawings if the owner has no other preference.
- C. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:
 - 1. Near each branch connection excluding short takeoffs for terminal units. Where flow pattern is not obvious, mark each duct at branch.
 - 2. Near penetrations through walls, floors, ceilings and nonaccessible enclosures.
 - 3. At access doors and similar access points that permit view of concealed ductwork.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 25' along each run.
 - 6. On ductwork above removable acoustical ceilings. Omit intermediately spaced markers

END OF SECTION 230553

SECTION 233113 - SHEET METAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all sheet metal work for supply, return, outside air, pressure relief, and exhaust air systems as specified and indicated on the drawings.
- B. All duct construction, gauges, methods of construction, and methods for hanging and supporting shall conform to SMACNA "HVAC Duct Construction Standards" third edition 2005, and all applicable codes.

PART 2 - PRODUCTS

2.1 LOW PRESSURE SUPPLY, RETURN & GENERAL EXHAUST DUCTS

- A. Rectangular Ducts
 - 1. All general exhaust air, pressure relief, low pressure supply air ducts, outdoor air and return air ducts shall conform to the duct construction, gauges, reinforcing and details shown conform to SMACNA Tables 1-5 (2" w.g.) and Tables 1-10 through 1-13. Additional reinforcing shall be installed where necessary to eliminate excessive movement and vibration.
 - 2. All rectangular branch takeoffs in supply ductwork shall be the 45° entry design with a manual damper.
- B. Round Ducts
 - 1. Low pressure round ducts 10" and smaller in diameter shall be constructed per SMACNA Table 3-2, 2" w.g. (pos.), first edition, 1985, for galvanized steel with grooved longitudinal seam and sleeved type transverse joint, pipe riveted. Hangers shall be 2" band, attached at duct joints with draw bands.
 - 2. Low pressure round ducts 12" and larger in diameter, and all exposed round ducts, shall be ASTM A-527-67 galvanized steel, United Sheet Metal Co. Spiral UniSeal Duct, Semco, or Wesco. All round fittings shall be United Sheet Metal Co. UniForm manufactured from galvanized steel with continuous welds.
 - 3. Double wall round duct shall be United Sheet Metal Acousti-K27 with perforated inner liner and 1" fiberglass blanket between inner and outer shell. All fittings shall be of the same construction. Gauges shall be as specified for single wall construction. Duct dimensions indicated on plans are inside diameter.
- C. All low pressure ductwork including exhaust air, return air, pressure relief, and outside air shall be sealed per SMACNA seal classification "B" requirements.

2.2 FLEXIBLE DUCTWORK

- A. Flexible ductwork is acceptable where indicated in medium pressure ductwork and shall be Flexmaster Type 8M, Thermaflex, ATCO, or approved equal, UL-181 Class I air duct, insulated, flexible duct with manufacturer's maximum working pressure rating of 6" W.G. The use of flexible duct run shall be limited to 3' on any single duct run. **INSTALL FLEXIBLE DUCT AS STRAIGHT AS POSSIBLE WITHOUT SAGGING. MAKE BENDS WITH MAXIMUM RADIUS POSSIBLE.**

- B. Flexible ductwork is acceptable where indicated in low pressure ductwork and shall be Flexmaster Type 8M, Thermaflex, ATCO or approved equal, UL-181 Class I air duct, insulated, flexible duct with manufacturer's minimum working pressure rating of 6" W.G. The use of flexible duct run shall be limited to 6' on any single duct run. INSTALL FLEXIBLE DUCT AS STRAIGHT AS POSSIBLE WITHOUT SAGGING. MAKE BENDS WITH MAXIMUM RADIUS POSSIBLE.
- C. Flexible duct shall incorporate mechanical lock construction. Manufacturers relying solely on adhesive locks will not be acceptable.
- D. Use duct manufacturer's best quality clamps for each application. Joint treatment shall utilize metal adjustable clamping devices, screw operated, or Panduit duct clamps having 175 lb. tensile strength and listed under UL Class I when installed in accordance with the manufacturer's instructions. For medium and high pressure service use Benjamin Foster Duct Sealer #30-02, Design Polymeric, Aeroseal, or equal at connection.

PART 3 - EXECUTION

3.1 SHEET METAL WORK

- A. This Contractor shall keep on the project at all times a set of SMACNA Standards with applicable sections marked for the Inspector's use. Before starting any construction of sheet metal work, the Contractor shall review applicable sections with the Inspector.
- B. Coordinate ductwork installation with other trades and verify the location of all light fixtures, pipes, beams, and other possible obstructions.
- C. Provide ductwork with a paintable finish where it is indicated to be exposed and painted on the architectural plans.
- D. Transitions in ductwork shall be constructed with angle of change in size at not more than 15° unless approved otherwise. Ductwork and housings shall be air-tight under all pressures that occur in the system. All elbows or offsets in rectangular ductwork under positive pressure that exceed 33° shall contain turning vanes. Sweep elbows with a centerline radius equal to or greater than the duct width, may be used without vanes.
- E. The supply ductwork on systems utilizing terminal boxes shall be constructed under medium pressure construction requirements from the discharge of the unit up to the inlet connection on the terminal box. All other ductwork is to be constructed to the low pressure construction requirements of this Section.
- F. All scratches or marks occurring in PCD ductwork shall be coated with two coats of PCD touch-up paint.
- G. All laboratory fume hood ducts and laboratory exhaust ducts fitting shall be oriented such that the male section inserts into the female section against the air flow to allow any condensation to flow down the ductwork and eliminate same from penetrating the duct joint sealer.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide duct accessories as specified and as indicated on the drawings.

1.2 APPROVED MANUFACTURERS

- A. The basis for this specification are those listed and shall represent the minimum level of construction. Equipment manufactured by Greenheck, Ruskin, Prefco, Penn, CESCO, and Ventlok shall be permitted to bid these specification.

PART 2 - PRODUCTS

2.1 BALANCING DAMPERS

- A. Provide manual balancing damper where indicated on the plans and as required by the test and balance contractor.
- B. Manual balancing dampers shall be Ruskin MD35 or approved equal, with 5" x 1" x 16 gage galvanized steel channel frame, 16 gage galvanized steel blades, steel shafts and molded synthetic shaft bearings. Linkage shall be arranged for opposed blade operation and shall be furnished with locking hand quadrant.
- C. Dampers in round ducts shall be Ruskin MDRS25 single blade with 20 gauge frame and 20 gauge blade.
- D. Dampers at takeoffs from rectangular trunk duct shall be as specified in the sheet metal section.

2.2 GRAVITY RELIEF DAMPERS

- A. Gravity relief dampers shall be Ruskin CBD6 or approved equal, with 2-1/4" x 7/8" x 1/8" aluminum channel frame and 0.070" aluminum blades with extruded vinyl edge seals and Oilite shaft bearings. Blades shall incorporate an adjustable counterbalance and shall be suitable for horizontal or vertical mounting.
- B. Backdraft dampers shall be Ruskin BD6 or approved equal, with 2-1/4" x 7/8" x 1/8" aluminum channel frame and 0.070" aluminum blades with extruded vinyl edge seals and Oilite shaft bearings.

2.3 ACCESS DOORS

- A. Hinged access doors shall be installed in housings where shown and where required for access to equipment. Insulated doors shall be installed in insulated or lined housings. Access doors construction, hardware, etc. shall be as detailed in SMACNA, HVAC Duct Construction Standards, 1985, Figure 6-12.
- B. Access doors shall be installed in ductwork where shown and where required for access to fire dampers, smoke damper, etc. Insulated access doors shall be used where installed in insulated or lined ductwork. Ductwork access doors shall be constructed to the pressure rating of the ductwork in which the access door is installed. Access doors shall be constructed per SMACNA Duct Construction Standards, 1985, Figure 2-12 using type 1 or type 2 locks only. Screwed access panels are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors for fire and or smoke dampers shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading:

FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER

END OF SECTION 233300

SECTION 233713 - GRILLES, REGISTERS, DIFFUSERS, AND LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all supply, return and exhaust registers, diffusers, grilles, and louvers as specified and as indicated on the drawings.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 3. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 APPROVED MANUFACTURERS

- A. The basis the grilles, registers, and diffusers are those listed and scheduled and shall represent the minimum level of construction. Units manufactured by EH Price, Carnes, Krueger, Titus and Nailor shall be considered equal to these specifications.
- B. The basis the louvers are those listed and scheduled and shall represent the minimum level of construction. Units manufactured by Industrial Louver, Louvers and Dampers, Penn Ventilator, Ruskin, and Greenheck shall be considered equal to these specifications.

PART 2 - PRODUCTS

2.1 AIR DIFFUSERS

- A. Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.

2.2 REGISTERS AND GRILLES

- A. Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
- D. Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "HVAC Plan".

END OF SECTION 233713

SECTION 260100 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions, General Requirements (Division 1), and Section 230513 - ELECTRICAL PROVISIONS OF HVAC WORK, and Section 220513 – ELECTRICAL PROVISIONS OF PLUMBING apply to the work specified in Division 26 - ELECTRICAL.

1.2 DESCRIPTION OF WORK

- A. The Electrical Contract includes all labor, material, and equipment required for the complete electrical systems as shown and specified.

1.3 QUALITY ASSURANCE

- A. Each major component of equipment shall have the manufacturer's name, address, model number, rating, and UL label securely affixed in a conspicuous place.
- B. All equipment of one type (such as panelboards, switches, wiring devices, etc.) shall be the product of one manufacturer, unless specified otherwise.
- C. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.

1.4 SHOP DRAWINGS AND SUBMITTALS

- A. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 26.
- B. Shop drawings for equipment ‘Packages’ shall be complete and include all items to be provided by a manufacturer’s representative or supply house. No partial submittals will be reviewed or approved without a complete and total equipment submittal.
- C. Each shop drawing shall include a letter indicating all deviations from the drawings and/or specifications.
- D. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
 - 2. Capacity, voltage, phase, ampacity, and other miscellaneous data to quantify the size of the equipment.
 - 3. Dimensional drawings showing layout, connection points, and detailed layout of components.
 - 4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.

5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the submittal.

E. Contractor shall check all shop drawings to verify that they meet the requirements of the drawings and specifications before forwarding to the architect and engineer. All shop drawings submitted shall bear the stamp of the contractor to show that they have been reviewed in detail.

F. No work shall be fabricated and no equipment ordered until the architect and engineer have returned acceptable reviewed shop drawings.

1.5 PROJECT SEQUENCING

A. The contractor shall refer to the architectural plans and specifications for areas of work and general schedules to determine the scope of work required during each phase of the construction.

B. All temporary services, temporary electrical connections to HVAC valves, dampers, etc. which are not indicated, but required by the phasing plan, shall be included in the base bid.

1.6 SUBSTITUTIONS

A. Refer to Section 006325 – Product Substitution Request.

1.7 DEFINITIONS

A. Furnish: The term “furnish” is used to mean “supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.”

B. Install: The term “install” is used to describe operations at the project site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”

C. Provide: The term “provide” means “to furnish and install, complete and ready for the intended use.”

1.8 RECORD DRAWINGS

A. During the progress of the work of this section, this Contractor shall maintain an accurate record of all changes made in the installation of the system(s). Upon completion of the work, accurately transfer all record information in AutoCad or Revit format. Provide final record drawings on CR-ROM and one plotted set. Insert one set into each of the operation and maintenance manuals described below.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Before project close-out, submit PDF of installation, operating, maintenance instructions, and parts lists for equipment provided. Include in the manual a list of emergency service organizations capable of rendering service for each piece of equipment.

B. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing the Owner has received the same.

C. At the completion of the project furnish to the Architect for the Owner, cut sheets and instruction manuals in PDF form, tabbed, containing all data, diagrams, capacities, spare part numbers, manufacturers service and maintenance data, warranties, guarantees, etc., including local contacts and escalation schedule complete with addresses and telephone numbers, of all equipment, apparatus, and

system components furnished and installed under this Division of the specifications.

1.10 CODES AND ORDINANCES

- A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.
- C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.11 WARRANTY

- A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.
- B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Where the quality of required material is not specified, the Contractor shall furnish a first class standard item as approved by the Architect/Engineer.
- B. Capacities of equipment and materials shall not be less than those indicated.
- C. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.
- D. Adequately protect equipment from damage after delivery to the jobsite. Cover with heavy polyethylene plastic. Elevate equipment when there is danger of water damage. Equipment damaged will be rejected.
- E. Any scratches to factory finishes shall be touched up using factory supplied paint before final acceptance. If extensive damage to factory finishes has occurred, equipment panels shall be replaced to the satisfaction of the engineer. If rust has formed, remove as recommended by the manufacturer prior to touch-up.

2.2 EQUAL PRODUCTS OF LISTED MANUFACTURERS

- A. In general, the specifications and drawings identify required materials and equipment by naming first the manufacturer whose product was used for the basis of design. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality, construction and dimensional requirements for comparing the other manufacturer's products. The capacity and performance of all equipment shall meet or exceed what is indicated on the drawings and/or scheduled.

- B. Where other manufacturer's names are listed, they are considered approved for the product specified.
- C. Where other than first named products are used, it shall be the responsibility of the contractor to determine prior to bid time that his proposed materials and equipment selections do not require adjustments in the mechanical or electrical connections as shown on the drawings. The contractor shall include in his bid all costs associated with any required adjustments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings reviewed by the Engineer.
- B. The complete installation shall function as designed and intended with respect to efficiency, capacity, and noise level, etc. Any abnormal noise caused by rattling equipment, conduit, or fixtures will not be acceptable.
- C. Locations of equipment, conduit, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.
- D. Any item interfering with proper placement of other work shall be removed and relocated without extra cost if reasonable coordination would have eliminated the interference. Damage to other work caused by this contractor shall be restored as specified for new work.
- E. Written dimensions are preferred over scaled dimensions. When written dimensions are not available, the contractor shall be responsible for determining the proper installed location.
- F. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.
- G. Contractor shall perform initial start-up of systems and shall provide necessary supervision and labor to make the first seasonal change-over of systems. Owner's operating personnel shall be present during this operation.
- H. It is the contractor's responsibility to provide materials and trim which fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

3.2 CONNECTIONS TO BUILDING STRUCTURE

- A. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.
- B. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.

3.3 CLEANING

- A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

3.4 EXISTING UTILITIES

- A. Locate and mark all known utilities prior to proceeding with work. Proceed with caution since unmarked utilities may exist on site.
- B. Should any existing utilities be damaged or disrupted, immediately notify Owner and repair to existing conditions.
- C. The Contractor shall closely coordinate all utility downtime with the Owner and Architect giving a minimum fourteen (14) day notice prior to downtime.
- D. Downtimes are to be held to a minimum duration with the Owner being notified as to the extent of said downtime.

END OF SECTION 260100

SECTION 260113 - ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall provide all conduit and wiring and shall connect complete and ready for operation all electrical motors and equipment in the other contracts. The other contractors shall furnish to the Electrical Contractor all switches, electrical controls, and other accessories required. Installation of all motors, equipment, etc., shall be made by the Contractor furnishing the equipment, except otherwise indicated.
- B. The Electrical Contractor shall provide disconnect switches as shown.
- C. The Electrical Contractor shall make all required electrical connections as hereinafter listed.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 ELECTRICAL CONNECTIONS

- A. The Electrical Contractor shall provide all conduit and wiring and shall connect complete and ready for operation all electrical motors and equipment for other trades as shown on the drawings and as required for complete and operating systems.
- B. For specific equipment listed below, provide the following:
 - 1. Mechanical/Plumbing/HVAC Items:
 - a. Domestic Water Pumps: The Electrical Contractor shall provide disconnects and motor starter/contactors as indicated. The Electrical Contractor shall make all required electrical connections.
 - b. Single Phase Exhaust Fans: The MC shall provide the single phase exhaust fans with disconnecting means. The Electrical Contractor shall provide the line voltage thermostat as may be indicated. The Electrical Contractor shall make all required electrical connections.
 - 2. Aquatic Items:
 - a. Domestic Water Pumps: The Electrical Contractor shall provide disconnects and motor starter/contactors as indicated. The Electrical Contractor shall make all required electrical connections.
 - b. Single Phase Exhaust Fans: Them MC shall provide the single phase exhaust fans with disconnecting means. The Electrical Contractor shall provide the line voltage thermostat as may be indicated. The Electrical Contractor shall make all required electrical connections.
 - c. Recirculation Pumps: The Electrical Contractor shall provide disconnects and motor starter/contactors (or VFD with integral disconnect as indicated. The Electrical Contractor shall make all required electrical connections.

- d. Flow Rider: The Electrical Contractor shall provide all connections for the defender filter system including control wiring between filter controller, VFD or motor starter, and all appurtenant devices. Provide all required electrical connections and components for a complete and code compliant installation. Reference manufacturer's installation manuals and submittal cut sheets for additional information.
- e. Defender Filter: The Electrical Contractor shall provide all connections for the defender filter system including control wiring between filter controller, VFD or motor starter, and all appurtenant devices. Provide all required electrical connections and components for a complete and code compliant installation. Reference manufacturer's installation manuals and submittal cut sheets for additional information.
- f. Chemical Controllers: The Electrical Contractor shall provide single pole switch (unless shown as duplex receptacle on plans) as indicated. The Electrical Contractor shall make all required electrical connections including duplex receptacles serving PH and chlorine feeders.

END OF SECTION 260113

SECTION 260114 - ELECTRICAL SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The electrical service shall be as indicated on the plans.
- B. This Contractor will provide all primary conduit, concrete support for pad-mounted transformer, and secondary conductors and conduits to interior main switch. Provide all items as required by the local utility standards.
- C. The contractor shall pay any and all required utility service fees associated with this project direct to the local utility company.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 COORDINATION WITH LOCAL UTILITY

- A. The descriptions of work below are general in nature. Contractor shall coordinate all work with the local utility and shall provide all items required by the local utility for a complete and operating service. Local utility is Laclede Electric Cooperative. Point of contact is Shane Dustin email sdustin@lacledeelectric.com. Phone number 417.532.3164.

3.2 ELECTRICAL CONTRACTOR WORK – UNDERGROUND SERVICE

- D. Service work will include secondary conduits and feeders, primary conduits, and support pad for transformer and sectionalizing switch as delineated on the plans and described above. Electrical Contractor shall leave adequate conductor length at the transformer to allow connections by the Electric Utility
- E. Contractor shall provide all trenching, backfilling, and pavement removal and replacement as necessary for the primary and secondary raceway systems.
- F. Contractor shall coordinate Service Installation with the local utility company.

3.3 LOCAL UTILITY COMPANY WORK – UNDERGROUND SERVICE

- A. Local utility company will provide all primary cable from the new sectionalizing switch to the primary compartment of transformer including sectionalizing equipment.
- B. Local utility company will provide all connections to primary equipment and shall make all transformer connections.
- C. Local utility company will provide the meter.
- D. Local utility company will provide all metering equipment CT's, wiring and meter installation on the side of the pad-mounted transformer.

END OF SECTION 260114

SECTION 260115 - ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The following is the work required by the General Contractor to facilitate the work of the Electrical Contractor.
 - 1. Openings and chases.
- B. The following is the work required by the Electrical Contractor to facilitate the work of his contract.
 - 1. Cutting and patching.
 - 2. Excavation and backfilling.
 - 3. Conduit sleeves.
 - 4. Related Documents
- C. Refer to Section 312000 – Earth Moving for backfilling requirements.
- D. Unless otherwise addressed in the specification, as a minimum, backfill in 6” lifts, compacting to a minimum of 95% proctor. The first 12” of fill above any buried item outside the building shall be sand in order to contrast with other fill material. Provide a yellow warning tape at the top of the sand layer.

PART 2 - PRODUCTS

2.1 CONDUIT SLEEVES

- A. Conduit sleeves and supports shall be provided and the Contractor shall be responsible for their proper and permanent location. Conduit will not be permitted to pass through footings or beams without consent of the Architect.
- B. Conduit sleeves will be required in all penetrations through new exterior walls, masonry walls, floors and fire rated gypboard walls. Sleeves shall be either Schedule 5 steel pipe, EMT conduit, field fabricated from minimum 16 gauge steel with 2" overlap at the seam, or as required by UL listed fire-stopping system.
- C. Conduit sleeves will not be required in existing wall penetrations of masonry construction when such openings are made by "core-drilling."

PART 3 - EXECUTION

3.1 GENERAL CONTRACTOR'S WORK

- A. The General Contractor shall leave such openings and chases in new construction for pipes, cabinets, access doors, and equipment as may be necessary or directed by the Architect to facilitate the work of the Electrical Contractor and to refinish around same. The Electrical Contractor shall properly advise in due time as to the location and sizes of such openings and chases.

3.2 ELECTRICAL CONTRACTOR'S WORK

- A. The Electrical Contractor shall be responsible for locating and setting his own sleeves, and be well aware of the job progress to avoid unnecessary delay for setting of same.
- B. The Electrical Contractor shall be responsible for cutting his own holes in existing construction, unless noted otherwise, and for patching and finishing around same. Any holes left in walls when existing devices or conduit is removed by the Contractor shall be patched and finished by the Contractor.
- C. The Electrical Contractor shall do all excavation and backfilling necessary to complete work under this contract. Lines shall be used to lay out the trenches for underground work. Trenches shall be of sufficient width and shall be cribbed and braced to prevent cave-in or settlement. Trenches close to walls and columns of the building shall not be excavated without the Architect's prior consent.
- D. Hand backfill and tamp into place at sides of conduits until installation has been approved.
- E. All sidewalks, street or alley surfaces that have to be broken in connection with this contract shall be patched to the satisfaction of the Architect.

3.3 CONDUIT SLEEVES

- A. Space between sleeves and conduit in outside walls shall be filled or tightly caulked with oakum, butyl rubber, link seals or other approved equally effective material to resist the penetration of water. Conduit sleeve shall be sufficient diameter to provide approximately 1/2" clearance around conduit.
- B. Space between sleeves and conduits in other wall construction shall be the diameter necessary to provide the clearance required by the UL listed fire stopping method chosen by the contractor. Shop drawings of the fire stopping method shall be approved prior to the setting of any sleeves and shall clearly define the fire stopping method and required sleeve clearances.
- C. Sleeves shall be set no closer than two pipe diameters center to center and shall be set 3/4" past all wall surfaces, and be securely anchored to the wall.

END OF SECTION 260115

SECTION 260515 – LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the wire as specified and the circuiting as shown on the drawings.

1.2 COLOR CODING OF WIRING

- A. Color coding for 120/240 volt systems shall be Black/Red for phase conductors, White for neutral and green for grounding conductors.

1.3 APPROVED MANUFACTURERS

- A. The basis for this specification is Southwire and shall represent the minimum level of construction. Material manufactured by Senator Wire and Cable, Encore Wire and Cable, and Cerro Wire LLC shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE WIRE (600V AND LESS)

- A. All power wires and cables shall be copper, minimum #12 awg, unless noted otherwise, and shall be Code Type THWN or THHN.
- B. All power wires and cables #10awg and smaller shall be annealed soft copper, solid construction, unless noted otherwise, and shall be Code Type THWN or THHN.
- C. All power wires and cables #8awg and larger shall be annealed soft copper, compressed strand construction, and shall be Code Type THWN-2 or THHN.
- D. All wiring shall be in conduit, unless noted otherwise.
- E. All HVAC equipment feeders shall be copper code type THWN/THHN.

PART 3 - EXECUTION

3.1 CIRCUITING

- A. The circuiting of all light and receptacle outlets has been shown on the plans, and the Contractor shall follow this circuiting layout.
- B. Each 120 volt outlet circuit shall be provided with dedicated neutral conductors. Three phase, four wire homeruns of 120 volt branch circuits will not be accepted.
- C. Each light fixture shall be provided with a dedicated fixture whip from a junction box. The practice of 'daisy-chaining' from fixture to fixture will not be accepted. Multiple fixture whips from a single box is acceptable.
- D. Machine or power pulling of cables into raceways shall be accomplished pulling stresses shall not exceed those recommended by the manufacturer.

- E. All cables shall be lubricated with "Polywater," or equally effective fire retardant material.

END OF SECTION 260515

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Supplement the grounded neutral of the electrical distribution system with an equipment grounding system, installed so that metallic enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment, etc., operate continuously at ground potential and provide a low impedance path for ground fault currents.
- B. The entire electrical system, including all special power systems, shall be grounded in accordance with the latest adopted version of the National Electrical Code.
- C. Grounding conductors shall be installed in conduits as shown on the drawings. Provide 100% rated dedicated grounding conductors per each 120-volt outlet circuit.
- D. Grounding conductors shall be installed in all PVC and Metal conduits.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall be manufactured by:
 - 1. Burndy
 - 2. B-Line Systems
 - 3. Crous Hinds
 - 4. Gould
 - 5. General Electric
 - 6. Ideal Industries
 - 7. Thomas and Betts
 - 8. Western Electric
- B. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC requirements and as noted on drawings.

2.2 ROD ELECTRODES

- A. Rod electrodes shall be copper, 5/8" diameter and 8'-0" long.

2.3 MECHANICAL CONNECTORS

- A. Provide electrical terminals, connectors, lugs, and clamps as recommended by the manufacturer's for the indicated applications.

1. Use mechanical (removable) clamps for connections to pipes.
2. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended for the types of services indicated.

2.4 GROUNDING BAR (PLATES)

- A. Provide ¼"x20"x4" copper bus bar manufactured by Chatsworth Products, Inc. Catalog #10622-020 with #10622-000 Hardware Kit. Products manufactured by Hubbell and TXM shall be permitted to bid these specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which electrical grounding connections are to be made and notify the Architect/Engineer in writing of conditions detrimental to proper completion of the work. Work shall not proceed until unsatisfactory conditions have been corrected.
- B. Provide all materials, labor, and equipment for an electrical grounding system in accordance with applicable portions of the NEC and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.
- C. Grounding and bonding of electrical installations and specific requirements of systems, circuits and equipment required to be grounded shall be accomplished in temporary and permanent construction.
- D. The path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample current carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.
- E. Where the size of the grounding conductor is not shown, they shall be sized in accordance with the NEC. All grounding conductors shall be a minimum of #12 AWG.
- F. Verify that final backfill and compaction has been completed before driving ground rod electrodes.

3.2 EQUIPMENT GROUNDING

- A. All receptacles shall be permanently connected to the grounding system with a green wire ground conductor.
- B. The metal frame of all motors shall be permanently connected to the grounding system with a green ground conductor.

3.3 INSTALLATION

- A. Provide a separate green equipment grounding conductor in all electrical raceways to effectively ground all devices, equipment, and non-current carrying enclosures. Metal conduit shall not be used as the grounding path. The grounding conductors shall be connected to the building electrical system ground.
- B. The path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample current carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.

3.4 SERVICE GROUNDING

- A. Provide service grounding per NEC Article 250 of the latest adopted Code version, and as shown on the drawings.
- B. At the service entrance equipment, bond the utility neutral, building neutral, and building grounding conductor at the building disconnecting means. Refer drawings for exact location and configuration. Connect the ground bus to the building domestic cold water pipe (within 5 feet of the water service entrance per NEC Article 250-50) with a grounding or bonding conductor.
- C. Service grounding shall comply with all applicable grounding requirements and rules of the Utility.
- D. The earth shall not be used as the sole equipment grounding conductor or fault current path

3.5 BONDING

- A. Provide bonding per NEC Article 250, and as shown on the drawings.
- B. Electrically conductive materials, such as metal water piping, metal gas piping, ductwork, and structural steel members, that are likely to become energized shall be bonded as specified in NEC Article 250 to the supply system grounded conductor. Or in the case of an ungrounded electrical system, to the electrical system grounded equipment, in a manner that establishes an effective path for fault current.

3.6 TESTING

- A. Measure ground resistance to earth. Install additional ground rod and conductors as required if resistance to earth ground is over 25 ohms.

END OF SECTION 260526

SECTION 260527 – EQUIPOTENTIAL BONDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The entire electrical system, including all special power systems, shall be grounded in accordance with the National Electrical Code.
- B. Grounding conductors shall be installed in all PVC conduits when routed through buildings.

1.2 EQUIPOTENTIAL BONDING SYSTEM DESCRIPTION OF WORK

- A. The contractor shall provide an Equipotential Bonding System in compliance with NEC 680.26, Equipotential Bonding. Reference the NEC for additional information.
- B. For renovation projects, the contractor shall only be responsible for bonding the new work and tying into the existing Equipotential Bonding System (unless noted otherwise).
- C. All of the following items shall be bonded together:
 - 1. Conductive Splash Pad Shell – Unencapsulated structural reinforcing shall be bonded together by steel tie wires or equivalent.
 - a. Spraygrounds
 - b. Surge Pits
 - 2. Perimeter Surfaces – Provide at least 6 points of connection between the items below that are within 3 ft of the splash pad surface and the conductive splash pad shell.
 - a. Reinforced Splash Pads & Walkways – Unencapsulated structural reinforcing shall be bonded together by steel tie wires or equivalent.
 - b. Bonding Loop – Provide a #8 bonding loop 18 to 24 inches from the inside of the splash pad walls and 4 to 6 inches below the subgrade.
 - 3. Metallic Components – All metallic parts of the splash pad structure shall be bonded.
 - 4. Metal Fittings – All metal fittings within or attached to the splash pad structure shall be bonded. Isolated parts not over 4” in any dimension and do not penetrate into the splash pad structure more than 1 inch shall not require bonding.
 - 5. Electrical Equipment – Metal parts of the electrical equipment associated with the splash pad water recirculating system, including pump motors and metal parts.
 - a. Splash Pad Pumps
 - b. Motor Starters and VFD’s
 - c. Filter Face and UV Filter Equipment (Alternate No. 1)
 - d. Splash Pad Heaters (bond water heater as recommended by manufacture)

6. Metal Wiring Methods
7. Splash Pad Water – If the splash pad does not have 9 square inches of metal surface area connected to the bonding loop, provide an intentional bond. Coordinate requirements with Splash Pad designer for exact requirements.

PART 2 - PRODUCTS

2.1 EQUIPOTENTIAL BONDING SYSTEM PRODUCTS

- A. All items shown on the Equipotential Bonding Schematic on Sheet E-101 – Detail 2 and noted in these specifications shall be bonded together with a bare #8 (or larger) copper solid conductor.
- B. Items shall be bonded with bonding conductors and jumpers. Jumpers shall be made of an identified non-corrosive material and connected by one of the following means:
 1. Pressure connectors listed as grounding and bonding equipment
 2. Terminal bars
 3. Exothermic welding process
 4. Machine screw-type fasteners that engage not less than two threads or are secured with a nut
 5. Thread-forming machine screws that engage not less than two threads in the enclosure
 6. Connectors part of a listed assembly
 7. Other listed means

PART 3 - EXECUTION

3.1 EQUIPOTENTIAL BONDING EXECUTION AND TESTING

1. The contractor shall test for continuity to all items at the end of construction.
2. The maximum allowable resistance between any two items shall be 5 ohms.
3. At the end of construction and before the engineer punches the facility, the contractor shall submit to the architect and engineer a plan and table showing compliance of the Equipotential Bonding System.
4. The table shall include all points tested and the measured resistance between the two points. The plan shall include all points included in the table.
5. For each sprayground, pump pit, and filter area, the contractor shall select one base point and a minimum of six equally spaced secondary points. The table shall include measured resistance between the base point and the secondary points. Additionally, the contractor shall test the resistance between the reference points.
6. All major items such as slides, ladders, handrails, etc., shall be included as secondary points.

END OF SECTION 260527

SECTION 260533 – ABOVE GROUND RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the conduits and raceways as specified and indicated on the plans.
- B. Provide all electrical pull, junction and outlet boxes as specified and shown on the drawings, as well as those required for a complete and code acceptable installation.

PART 2 - PRODUCTS

2.1 CONDUITS (600 VOLT AND LESS)

- A. 2” diameter and larger: All exterior above grade conduits shall be rigid steel conduit or intermediate metal conduit with threaded couplings and fittings.
 - 1. Rigid metal conduit shall be hot-dip galvanized steel. Threads shall be hot galvanized after cutting. Conduit shall be produced in accordance with UL Safety Standard #6 and ANSI C80.1.
 - 2. Intermediate metal conduit shall be hot galvanized steel OD with an organic corrosion resistant ID coating. Threads shall be hot galvanized after cutting. Conduit shall be produced in accordance with UL Safety Standard #1242 and ANSI C80.6.
- B. Less than 2” diameter: All exterior above grade conduits shall be Schedule 40 PVC.
- C. All other conduit shall be Schedule 40 PVC with bare copper ground.

2.2 NON-METALLIC SURFACE RACEWAY

- A. Surface raceway shall be Hubbell Wall Trak PW2, Model PW2BC5 non-metallic latching, 2 compartment raceway. Products manufactured by Legrand and Wiremold shall be permitted to bid these specifications.
- B. Raceway system shall be specifically designed for category 5 wiring systems complete with engineered large radius fittings to maintain 1-1/4" heading radius for data cabling as specified by TIA/EIA standards.
- C. Provide with all fittings and outlet boxes, on centers indicated, as required for the complete non-metallic raceway system, including but not limited to:
 - 1. PDB12S single gang, standard depth device box for outlets with KP8 covers
 - 2. Wiring devices per Section 262726
 - 3. PDB12S single gang, standard depth data box for computer ports with KP14 blank covers.
- D. Non-metallic raceway shall be constructed of off-white rigid PVC material complete with UL listing with self-extinguishing comparable with UL Standard 94VO.

2.3 JUNCTION AND PULL BOXES

- A. Interior Junction and pull boxes shall be Schedule 40 PVC.

2.4 OUTLET BOXES

- A. All outlet boxes for light fixtures, receptacles, and wall switches shall be Schedule 40 PVC. Lighting fixture outlet boxes in ceiling shall be not less than 4" square of the knockout type.

2.5 BOXES AND CONDUIT FOR DATA AND/OR PHONE OUTLETS

- A. Unless noted otherwise, for data/phone outlets, provide a 4x4 deep Schedule 40 back box. Extend a ¾" conduit up inside the wall, roll horizontal in the ceiling space, and provide a protective bushing at the end of the conduit. Where ceiling is drywall or other inaccessible surface, extend the conduit to the nearest accessible location and provide a label at the end of the conduit indicating outlet location.

PART 3 - EXECUTION

3.1 CONDUITS (600 VOLT AND LESS)

- A. Single tubes will be used for all circuits, but more than one circuit may be carried in each conduit, provided the number of conductors and size of conductors are proportioned in accordance with the rules of the NEC, and conduits are amply large to allow for removal and replacement of conductors when necessary. (40% fill rate.)
- B. Where conduit is carried in walls, it shall be thoroughly bedded and not visible. In placing conduits, they shall be so located as to not weaken or injure the construction of the building in any way, and the installation of these shall be approved by the Architect.
- C. Joints must be made so the ends of the pipes come together in the center of the coupling.
- D. All conduit shall be run parallel or perpendicular to the building surfaces.
- E. All conduit shall be concealed except in mechanical, filter, and electrical rooms and at all electrical panelboards.
- F. Before pipes are covered with concrete, they shall be fished by the Contractor with a steel fish tape to insure that there is no obstruction in the pipes.
- G. All empty conduit systems shall be provided with pull strings.

3.2 SURFACE MOUNTED RACEWAY

- A. Surface raceway and fittings shall meet all requirements of the National Electrical Code and shall be UL listed and in full compliance with their standard #UL-5.

3.3 JUNCTION AND PULL BOXES

- A. Junction and pull boxes shall be provided throughout in accessible locations. Locations shall be approved by the Architect or his representative before installation.

3.4 OUTLET BOXES

- A. Outlets shall be installed in the locations shown on the drawings, except outlets may be moved 4 feet in either direction if so directed before roughing, without additional cost to the Owner. Outlet boxes shall be flush mounted on all walls for concealed work.

- B. Installation of all outlet boxes shall strictly conform to Article 300 of the National Electrical Code.

3.5 SWITCH AND OUTLET BOXES

- A. Switch and outlet boxes installed in concrete and masonry construction shall be straight and level. The Electrical Contractor shall work closely with the General Contractor and masons to insure proper installation to the satisfaction of the Architect.

3.6 THERMOSTAT ROUGH-INS.

- A. The Electrical Contractor shall provide rough-in boxes and ½” conduit for thermostats under the supervision of the temperature controls installation contractor. Reference mechanical plans for thermostat locations.

END OF SECTION 260533

SECTION 260543 – UNDERGROUND RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the conduits and raceways as specified and indicated on the plans.
- B. Provide all electrical pull and junction boxes as specified and shown on the drawings, as well as those required for a complete and code acceptable installation.
- C. Submit locations for all junction and pull boxes to be installed around the splash pad area. Submittal shall show all major conduit routing around the splash pad area. Box locations and conduit routing shall be approved prior to installation. Locations shall be approved by the Architect prior to installation.

1.2 APPROVED MANUFACTURERS

- A. The basis for the underground conduit is Carlon and shall represent the minimum level of construction. Material manufactured by Allied Tube, J.M. Eagle, and CCP shall be permitted to bid these specifications.
- B. The basis for junction boxes is Hubbell and shall represent the minimum level of construction. Products manufactured by alternate manufacturer's shall be permitted to bid these specifications upon submission and acceptance via addenda.

PART 2 - PRODUCTS

2.1 CONDUITS (600 VOLT AND LESS)

- A. Unless indicated otherwise, all exterior underground conduits and all conduit poured in or under building slabs shall be Schedule 40 PVC with bare copper ground wire. Change to metal rigid conduit at elbow turning up to above grade.
 - 1. Nonmetallic conduit shall be manufactured to NEMA TAC-2, federal specifications WC1094A and UL 651 specifications. Fittings shall be manufactured to NEMA TC-2, federal specifications WC1094A and UL 514B specifications. Both conduit and fittings shall carry respective UL or ETL listing and labels.

2.2 CONDUITS (HIGH VOLTAGE AND UNDERGROUND SERVICE)

- A. All underground high voltage service conduits shall be heavy wall Schedule 40 PVC utility conduit with UL Label. Conduit shall be free of burrs and have clean bores.
 - 1. Nonmetallic conduit shall be manufactured to NEMA TAC-2, federal specifications WC1094A and UL 651 specifications. Fittings shall be manufactured to NEMA TC-2, federal specifications WC1094A and UL 514B specifications. Both conduit and fittings shall carry respective UL or ETL listing and labels.
- B. All fittings and bends 45 degrees and less shall be deep socket type schedule 40 utility elbows with 36" radius. All 90 degree conduit bends shall be PVC coated rigid metal having a minimum 36" radius. Parallel runs of conduit shall be installed with a minimum 12" horizontal separation.

2.3 EXTERIOR JUNCTION BOXES (600 VOLT AND LESS)

- A. Exterior junction boxes shall be equal to Hubbell 'Quazite' PG style, polymer concrete, gasketed junction boxes. Each box shall be a minimum of 11 x 18 and be complete with all accessories. Box size shall be determined by the cabling and conduits quantities associated with each box. Products manufactured by Hoffman and Square D, or approved equal shall be permitted to bid these specifications.
- B. Provide cover with stainless steel bolts and logo indicating "Electric".

PART 3 - EXECUTION

3.1 CONDUITS (600 VOLT AND LESS)

- A. Single tubes will be used for all circuits, but more than one circuit may be carried in each conduit, provided the number of conductors and size of conductors are proportioned in accordance with the rules of the NEC, and conduits are amply large to allow for removal and replacement of conductors when necessary. (40% fill rate.)
- B. Joints must be made so the ends of the pipes come together in the center of the coupling.
- C. Before pipes are covered with concrete, they shall be fished by the Contractor with a steel fish tape to insure that there is no obstruction in the pipes.
- D. All empty conduit systems shall be provided with pull strings.

3.2 CONDUIT (SERVICE AND HIGH VOLTAGE)

- A. Conduit shall be installed in 48" deep trench and shall be laid with a slope of 6" per hundred feet and drain into the pull boxes indicated on the plans.
- B. Pull wire shall be provided in spare conduit. Pull string shall be Greenlee or equal with a minimum of 240 lbs. tensile strength and shall be rot and mildew resistant. Products manufactured by Klein and CWC shall be permitted to bid these specifications.
- C. Yellow plastic caution tape shall be installed 12" below finish grade to warn others of the cable installation.

END OF SECTION 260543

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all items of electrical identification as specified.

PART 2 - PRODUCTS

2.1 PANEL SCHEDULE CARDS AND LABELS

- A. Inside each panel door, provide an approved typewritten schedule card showing what each circuit feeds.
- B. Switches in main distribution panel shall be clearly and permanently labeled with engraved, white on black laminated plastic plate, mechanically affixed.
- C. Provide engraved, white on black, laminated plastic plate, mechanically affixed labels on all panels, transformers, safety switches, motor starter, etc. Where panels, etc., occur in finished rooms, label shall be on inside of the door. Labels shall match designation indicated on the plans.
- D. Provide engraved cover plates for switches controlling motor starters, fans, and other items of mechanical equipment.

PART 3 - EXECUTION

END OF SECTION 260553

SECTION 260939 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Contractor shall provide a complete occupancy sensor control devices as indicated on the drawings and specified herein.
- B. The contractor shall provide a Lighting control System that meets all performance requirements in accordance with approved plans and specifications.
- C. The “Lighting control system” as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls and architectural dimming controls.

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "Listed" and "Labeled" are used as defined in the National Electrical Code, Article 100.

1.3 APPROVED MANUFACTURERS

- A. The basis for the low voltage switching is Wattstopper shall represent the minimum level of construction. Products manufactured by Cooper, Acuity, and other manufacturers shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 TIME SWITCHES (I.E. TIME CLOCKS)

- A. Reference plans for manufacturers and model numbers.

2.2 OCCUPANCY SENSORS

- A. Reference plans for manufacturers and model numbers.

2.3 CIRCUIT CONTROL HARDWARE

- A. Relay Contacts shall have ratings of:
 - 1. 20A - 120 VAC Ballast
- B. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- C. Minimum acceptable wire gauge from the circuit control hardware relays shall be #12 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Sensors: It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- B. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.
- C. Delivery/installation of Lighting control Panels and Time Switches: The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements. The following items shall constitute factory standards and requirements:
 - 1. All system equipment shall operate in accordance with specification and industrial standard procedures.
 - 2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.
 - 3. Demonstration of program integrity during normal operation and pursuant to a power outage.
 - 4. Contractor shall provide a minimum of two training hours on the operation and use of the control system. Additional support services shall be negotiated between the contractor and the building owner or manager. Please refer to Section 017900 Training and Demonstration.

END OF SECTION 260939

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the panelboards as specified and scheduled on the plans.

1.2 APPROVED MANUFACTURERS

- A. The basis for this specification is Square D; Schneider and shall represent the minimum level of construction. Products manufactured by GE Electrical Distribution & Control, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 120/240 VOLT PANELBOARDS

- A. Provide the following Square D, type NQ, Single phase, 3-wire panelboards with circuit breakers as scheduled.
- B. Provide panels with ground bars, surface mounted cabinets and UL label.
- C. Circuit breakers shall be Square D Type QO (plug-on) or QOB (bolt-on) thermal-magnetic molded case circuit breakers. Type QO-GFI ground fault breakers and QO-CAFI combination arc breakers shall be provided as indicated and required by the NEC. Breakers shall be 1 or 2 with an integral crossbar to assure simultaneous opening of all poles in multi-pole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON," "OFF" and "TRIPPED" positions. Plug-on (QO) and bolt-on (QOB) circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. Interrupting ratings shall be 10,000 rms symmetrical amps maximum at 208Y/120 volts ac maximum. Other frames are available with higher AIC ratings, refer to notes in panel schedules on the plans.
 - 1. AFCI – Arc Fault breakers shall be provided for all circuits as required in section 210.12 of the NEC
- D. Panelboard bus structure and main lugs or main circuit breaker current ratings as specified. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" type and shall accept either plug-on (QO) on bolt-on (QOB) circuit breakers. All current carrying parts of the bus structure shall be plated.
- E. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboards' locks shall be keyed alike. Fronts shall have trim screws which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory card with a clear plastic covering shall be provided on the inside of the door.

- F. Where panelboard is indicated with main circuit breaker, provide Type HD breakers for 100 amp panels (25 Kaic), provide Type JD breakers for 200 amp panels (25 Kaic), and Type LD breakers for 400 amp panels (25 Kaic), Other frames are available with higher AIC ratings, refer to notes in panel schedules on the plans.
- G. Panels shall be as indicated and scheduled on the plans.
- H. Surge Protective Devices – per the requirements in Section 264313 where panels are indicated on drawings or scheduled to be provided with SPD (TVSS).

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the wiring devices cover plates, relays and contactors, time clocks, and photoelectric cell equipment as specified.

1.2 APPROVED MANUFACTURERS

- A. The basis for this specification is Hubbell and shall represent the minimum level of construction. Products manufactured by Pass and Seymour and Eagle shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. The following devices shall be as manufactured by Hubbell, or approved equal. They shall be rated at 20 amps, 120/277 volts, unless specified otherwise. Verify device color with architect before ordering.
- B. All devices shall be gray, white, brown, black in color, unless noted otherwise. Devices shall be as follows:

1. Switches:

- a. S.P.S.T. Hubbell CSB120
- b. 2-pole switch Hubbell CSB220
- c. 3-way switch Hubbell CSB320
- d. 4-way switch Hubbell CSB420
- e. Keyed switch Hubbell HBL1221L
- f. 2-pole keyed switch Hubbell HBL1222L
- g. 3-way keyed switch Hubbell HBL1223L
- h. 4-way keyed switch Hubbell HBL1224L
- i. S.P.S.T. with pilot light – 120v Hubbell HBL1221PL
- j. S.P.S.T. with pilot light – 277v Hubbell HBL1221PL
- k. Auto/Off switch Hubbell CS1221
- l. Chiller/Boiler/ Water Heater
- m. Emergency Shutdown switches Square D KR9RH13
- n. Chiller emergency

- o. Ventilation switch Square D KR9RH13
2. General Wall Receptacles:
- a. 120 volt duplex outlet Hubbell CR5352AG
 - b. Tamper resistant Hubbell BR20TR
 - c. Isolated Ground outlet Hubbell CR5352IG
 - d. Single outlet Hubbell HBL5361
 - e. Drinking fountain/Vending Hubbell GF20L
 - f. GFI outlet Hubbell GF20L
 - g. Weatherproof outlet Hubbell GF20L with RW57400 cover
 - h. Range Outlet (50 amp, 120/240) Hubbell RR450F /SS703 cover plate (NEMA 14-50)
 - i. Dryer Outlet (30 amp, 120/240) Hubbell RR430F w/SS703 cover plate (NEMA 14-30)
3. Multi-Outlet Wall and Floor Boxes:
- a. Type A: Hubbell HBLWSCS2, two gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV and data/phone outlets. Provide HBLTRIM2W wall flange. Provide receptacles as indicated on plans and described above.
 - b. Type A: (Installation in Masonry) Hubbell HBLWSCS2MBD, two gang box with all accessories above. Use HBLSCSBMBD barriers where required for voltage separation.
 - c. Type B: Hubbell HBLWSCS3, three gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV and data/phone outlets. Provide HBLTRIM3W wall flange. Provide receptacles as indicated on plans and described above.
 - d. Type B: (Installation in Masonry) Hubbell HBLWSC3MBD, three gang box with all accessories above. Use HBLSCSBMBD barriers where required for voltage separation.
 - e. Type C: Hubbell HBLWSCS4, four gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV, data/phone outlets, and spare gang. Provide HBLTRIM4W wall flange. Provide receptacles as indicated on plans and described above.
 - f. Type C: (Installation in Masonry) Hubbell HBLWSCS4MBD, four gang box with all accessories above. Use HBLSCSBMBD barriers where required for voltage separation.
 - g. Type D: Hubbell HBLWSCS6, six gang box with HBLSCSBW barriers as required for voltage separation. Provide HBLST302S duplex face plates for receptacles and HBLBL300S blank plates for CATV, data/phone outlets and spare gang. Provide HBLTRIM6W wall flange.

- h. Type D: (Installation in Masonry) Hubbell HBLWSCS6MBD, six gang box with all accessories above. Use HBLSCSBMBD barriers where required for voltage separation.

2.2 COVER PLATES

- A. All flush-mounted wiring devices shall be provided with Hubbell SS Series Stainless Steel plates in the configuration and number of gangs as required.
- B. Cover plates for wiring devices in surface-mounted boxes shall be galvanized utility box covers, raised 1/4".
- C. Where more than one device is in a single location, a one-piece multi-gang cover plate shall be used.
- D. All cover plates for switches controlling mechanical equipment and where indicated on the drawings, shall be stainless steel with standard 1/8" high engraved characters and black filler.
- E. All cover plates for receptacles in hospitals shall be engraved with the panelboard and circuit number serving the device.

2.3 RELAYS AND CONTACTORS

- A. Provide Square D and ECG Phillips, or approved equal, I.T.E., Zenith or ASCO, relays and contactors as shown on the plans.

2.4 TIME CLOCKS

- A. Time clocks shall be EZ Controls, or approved equal Paragon or Intermatic, Model EZ-701-2, 2PST maintained contact time switch with 25 amp rated controls.
- B. Time clocks shall be based on solid state technology with 10-year memory retention and rechargeable battery carryover.

2.5 PHOTOELECTRIC CELL

- A. Provide an Intermatic, Legrand, Hubbell, or approved equal, model #K4021, 120 volt, 1800 watt photo-electric cell.

PART 3 - EXECUTION

3.1 DEVICE ELEVATIONS

- A. Devices shall be set at the following elevations from the finished floor to the top of the box, unless otherwise indicated on the plans:
 - 1. Light switches 48"
 - 2. Control switches 48"
 - 3. Thermostats 48"
 - 4. Telephone outlets 16" Btm
 - 5. Convenience receptacles 16" Btm

- 6. Isolated Ground receptacles..... 16” Btm
- 7. Drinking fountain receptaclesAs required by manufacturer
- B. Boxes for wall mounted light fixtures shall be at elevations noted on the plans.
- C. Ground fault interrupter receptacles shall be provided in all locations as required in Section 210.8 of the latest adopted version of the NEC

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide fuses as specified and shown.

1.2 APPROVED MANUFACTURERS

- A. The basis for this specification is Bussman and shall represent the minimum level of construction. Products manufactured by Gould Shawmut and Mersen shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 FUSES

- A. Circuits 0 to 600 ampere shall be protected by current limiting Bussmann Low-Peak Dual-Element Fuses LPN-RK (250 volts) and LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284° F melting point alloy and shall be independent of the short circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

PART 3 - EXECUTION

3.1 FUSES

- A. Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site, or from water that may contact the fuse before the equipment is installed. All fuses shall be of the same manufacturer, unless noted otherwise.
- B. Provide Bussman 24 x 30 x 12 model SFC-FUSE-CAB spare fuse cabinet. Provide spare set of fuses for all units larger than 601 amps.

END OF SECTION 262813

SECTION 262816 - SAFETY SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide heavy-duty safety switches as indicated on the plans and as specified. All safety switches shall be NEMA Type HD and Underwriters Laboratories listed.

1.2 Approved Manufacturers

- A. The basis for this specification is Square D; Groupe Schneider and shall represent the minimum level of construction. Products manufactured by GE Electrical Distribution & Control, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

- A. Provide Square D heavy duty grade safety switches in configuration noted.
- B. All switches shall have switchblades, which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60° C or 75° C aluminum or copper wires.
- C. Switches shall be quick-make, quick-break, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF."
- D. Switches shall be furnished in NEMA 1 general-purpose enclosures unless specified as NEMA 3R on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches through 200 amps shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked-enamel finish, electrodeposited on cleaned, phosphatized steel.
- E. All fusible switches rated 100 through 600 amps at 240 volts and 30 through 600 amps at 600 volts, shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amps when Class R or Class J fuses are used with the appropriate rejection scheme. 800 and 1200 amp switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amps.

END OF SECTION 262816

SECTION 262913 – MOTOR STARTERS AND CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide NEMA rated magnetic motor starter, and manual motor controllers, for all motors provided either in this contract, or the Mechanical Contract as indicated on the plans and as specified. All motor starters shall be NEMA rated and Underwriters Laboratories listed.
- B. Controllers shall be furnished within dedicated enclosures, or as combination/disconnect controllers as indicated on the plans.

1.2 QUALITY ASSURANCE

- A. Perform work in accordance with NECA Standard of Installation.

1.3 APPROVED MANUFACTURERS

- A. The basis for this specification is Square D; Groupe Schneider and shall represent the minimum level of construction. Products manufactured by GE Electrical Distribution & Control, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURES: FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER

- A. Square D - Class 2510 Type F. (For single-phase fractional Hp Pumps and motors)
 - 1. Description: NEMA ICS 2, ac general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, toggle operator, and handle guard lock.
 - 2. Enclosure: ANSI®/NEMA ICS 6, Type 1 or 3R as noted on plans

2.2 MANUFACTURES: MAGNETIC MOTOR CONTROLLERS - NON-REVERSING

- A. Square D - Class 8536 Type S.
 - 1. Description: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
 - 2. Coil operating voltage: 120 volts, 60 Hz.
 - 3. Coil: Be of encapsulated type.
 - 4. Poles: Three, unless indicated otherwise
 - 5. Size: as indicated on plans
 - 6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

7. Wiring: Straight-through wiring with all terminals clearly marked.
8. Overload Relay: NEMA ICS
 - a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. It will also be available in Trip Class 10 or 20 and have a mechanical test function.
 - b. Outputs: Unit will be designed for addition of either a normally open or normally closed auxiliary contact and be field convertible.
 - c. Reset: Unit shall offer both manual reset and remote reset using an external module.
9. Enclosure: ANSI/NEMA ICS 6, Type 1 or 3R as noted on plans

B. Product Options and Features

1. Auxiliary Contacts: NEMA ICS 2, 2 each normally open and normally closed contacts in addition to seal-in contact.
2. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty type.
3. Pilot Device Contacts: NEMA ICS 2, Form Z.
4. Push Buttons: Unguarded
5. Selector Switches: Rotary type
6. Relays: NEMA ICS 2,
7. Control Power Transformers: [120] [] volt secondary, [VA minimum, in each motor starter.] [as scheduled.] Provide fused [primary and] secondary, and bond unfused leg of secondary to enclosure.

2.3 MANUFACTURES: DISCONNECT SWITCH TYPE COMBINATION MAGNETIC MOTOR CONTROLS - NON-REVERSING

A. Square D - Class 8538 Type S.

1. Description: Combine magnetic motor controllers with either non-fusible switch or fusible switch disconnect, as indicated on plans, in common enclosure. Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/OFF with red and black color-coding.
 - a. Nonfusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and visible blades. Operating handle shall give positive visual indication of ON/OFF with a color-coded operating handle.
 - b. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses and visible blades. Operating handle shall give positive visual indication of ON/OFF with a color-coded operating handle.

2. Switch shall have fuse clips to accept Dual element, time delay, in 250 or 600 volt, Class RK 1 or RK 5 Interrupting Rating: 200,000 rms amperes.
3. Magnetic Motor Controllers: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
4. Coil operating voltage: 120 volts, 60 Hz.
5. Coil: Be of encapsulated type.
6. Poles: Three, unless indicated otherwise
7. Size: as indicated on plans
8. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
9. Wiring: Straight-through wiring with all terminals clearly marked.
10. Overload Relay: NEMA ICS
 - a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. It will also be available in Trip Class 10 or 20 and have a mechanical test function.
 - b. Outputs: Unit will be designed for addition of either a normally open or normally closed auxiliary contact and be field convertible.
 - c. Reset: Unit shall offer both manual reset and remote reset using an external module.
11. Enclosure: ANSI/NEMA ICS 6, Type 1 or 3R as noted on plans

B. Product Options and Features

1. Auxiliary Contacts: NEMA ICS 2, 2 each normally open and normally closed contacts in addition to seal-in contact.
2. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty type.
3. Pilot Device Contacts: NEMA ICS 2, Form Z.
4. Push Buttons: Unguarded
5. Selector Switches: Rotary type.
6. Relays: NEMA ICS 2,
7. Control Power Transformers: [120] [] volt secondary, [VA minimum, in each motor starter.] [as scheduled.] Provide fused [primary and] secondary, and bond unfused leg of secondary to enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed controllers plumb.
- C. Height: 5 ft (1.6 m) to operating handle.
- D. Install fuses in fusible switches.
- E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- F. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.2 Field Quality Control

- A. Inspect and test each enclosed controller to NEMA ICS 2.

END OF SECTION 262913

SECTION 262923 - VARIABLE SPEED CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the variable frequency controllers as specified and as indicated on the drawings.

This section provides specification requirements for solid-state, pulse-width modulated (PWM) Adjustable Frequency Drives, herein referred to as AC Drives, for use with NEMA® design AC motors.

This specification section applies to the air handling units, pumps, and exhaust fans as indicated on the control drawings.

1.1 REFERENCES

ANSI®/NFPA® 70 - National Electrical Code® (NEC)

- A. B. UL 508 - UL Standard for Industrial Control Equipment
- B. C. UL 508C - UL Standard for Power Conversion Equipment
- C. D. NEMA ICS 7.1

1.2 ADDITIONAL WARRANTY REQUIREMENTS

- A. A one year warranty shall be provided on materials and workmanship from the date of substantial completion of the total project.

1.3 APPROVED MANUFACTURER

- A. The basis for this specification is Square D; Groupe Schneider E-Flex Variable Frequency Motor Controllers for HVAC and Pumping Applications (1-50 hp at 208/230 V and 1-100 hp at 460 V)
- B. and shall represent the minimum level of construction. Products manufactured by ABB, Eaton/Cutler-Hammer, Magnetek, and Siemens shall be permitted to bid these specifications.

1.4 SUBMITTALS

- A. A submittal package, including drawings, shall be furnished for the Engineers' approval prior to factory assembly of the AC Drives. These packages shall consist of elementary power and control wiring diagrams, and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, and conduit entrance locations. Standard catalog specification sheets showing voltage, horsepower, and full load current ratings shall be furnished as part of the submittal package.

1.5 QUALITY ASSURANCE

- A. The manufacturer of the AC Drive shall be a certified ISO 9001 facility.
- B. The AC Drive and all associated optional equipment shall be UL Listed according to UL 508C - Power Conversion Equipment. As verification, a UL label shall be attached on the inside of the combination enclosure. A UL 508A panel builders label does not meet this specification.
- C. The AC Drive shall be designed, constructed, and tested in accordance with UL, cUL NEMA, and NEC standards.
- D. Every power converter shall be tested with an AC induction motor while under load.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage.

- B. The input power section shall utilize a full wave bridge design. The rectifiers shall convert AC line power of fixed voltage and frequency to fixed DC voltage.
- C. The output power section shall change fixed DC voltage to adjustable frequency AC voltage.
- D. The adjustable frequency NEMA (Type 1, 12, or 3R) drive package shall consist of a circuit breaker disconnect, an optional 2- or 3-contactor bypass, 120 V control transformer, and control circuit terminal board for digital and analog field wiring.
- E. The Hand-Off-Auto switch, Speed Potentiometer and Adjustable Frequency Controller-Off-Bypass switch shall be mounted and wired to the drive door or located on the drive keypad.
- F. The entire drive package, including the bypass starter circuit, shall be UL 508C listed and coordinated with NEMA ICS 7.1. A UL 508A panel builders label does not meet this specification.

2.2 CONSTRUCTION

- A. The AC Drive power converter shall be enclosed in a NEMA (Type 1, 12, or 3R) enclosure with a circuit breaker disconnect, user terminal strip connections, and optional bypass controls. The enclosure shall provide dedicated user terminals for power and control device connection.
- B. Provisions shall be included for locking the disconnect in the Off position with a padlock.
- C. All enclosure and heat sink fans shall be accessible from the front and shall not require the removal of the AC drive power converter for fan replacement.

2.3 APPLICATION DATA

- A. The AC Drive shall be sized to operate a variable torque load.
- B. The speed range shall be from a minimum speed of 1.0 Hz to a maximum speed of 72 hz.

2.4 ENVIRONMENTAL RATING

- A. The AC Drive shall meet IEC 60664-1 Annex A and NEMA ICS 1, UL, and cUL standards.
- B. The AC Drive shall be designed to operate in an ambient temperature from -10 to 40 °C (14 to 104°F).
- C. AC Drives in Type 3R enclosures shall be designed to operate in an ambient temperature from -10 to 50 °C (14 to 122 °F).
- D. The storage temperature range shall be -25 to 65 °C (-13 to 149 °F).
- E. The maximum relative humidity shall be 95%, non-condensing,
- F. The AC Drive shall be rated to operate at altitudes less than or equal to 3300 ft (1000 m). For altitudes above 3300 ft (1000 in), the AC Drive should be de-rated according to drive specifications up to 10,000 ft.
- G. The AC Drive shall meet the IEC 60721-3-3-3M3 operational vibration specification.
- H. The AC Drive shall include an option which will ensure that the drive is Seismic Qualified to 2003 IBC Level 3 "Extreme" rating with an Importance Factor $I_p=1.5$.

2.5 RATINGS

- A. The AC Drive shall be designed to operate at the input line voltage indicated on the equipment schedule. The AC Drive shall operate from an input frequency range of 60 Hz \pm 15%.
- B. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
- C. The efficiency of the AC Drive shall typically be 96% or greater.
- D. The variable-torque rated AC Drive overcurrent capacity shall be not less than 110% for 1 minute.
- E. The output carrier frequency of the AC Drive shall be programmable at 0.5, 1, 2, 4, 8 or 12 kHz. In addition, the output carrier frequency shall be modulated around the selected frequency.

2.6 PROTECTION

- A. Upon power-up, the AC Drive shall automatically test for valid operation of memory, loss of communication, DC-to-DC power supply, control power, and pre-charge circuit.
- B. The enclosure shall provide a fully coordinated 100,000 AIC current rating marked on the enclosure nameplate, with short circuit coordination to UL 508C Power Conversion Equipment and NEMA ICS 7.1.
- C. The AC Drive shall be protected against short circuits, between output phases and phase to ground.
- D. The AC drive power converter shall have a ride-through function, which will allow the logic to maintain control for a minimum of one second (60 cycles).
- E. For AC drives that automatically reset after a detected fault is cleared, an auto restart function will provide programmable restart attempts. The time delay before restart attempts will be 1 second, 5 seconds, 10 seconds, and then 1 minute thereafter.
- F. Upon loss of the 4-20 mA analog process follower reference signal, the AC Drive shall be programmable to display a detected fault code.
- G. The AC drive power converter shall have a solid-state UL 508C listed overload protective device and meet IEC 60947,
- H. The output frequency shall be enabled to fold back when the drive is in an overcurrent condition.
- I. There shall be three skip frequency ranges that can be programmed to a bandwidth of 0.1 to 10 Hz,

2.7 ADJUSTMENTS AND CONFIGURATIONS

- A. The AC Drive will be factory programmed to operate all specified optional devices.
- B. The acceleration and deceleration ramp times shall be adjustable from 0.05 to 999.9 seconds.
- C. The memory shall retain and record run status, detected fault type, motor current, output frequency, elapsed time, mains voltage, motor thermal state, command channel, channel reference active, and status word information in the diagnostic fault history.

2.8 KEYPAD DISPLAY INTERFACE

- A. A graphic display interface shall offer the modification of AC Drive adjustments through a membrane keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, diagnostics fault history, local control, configuration storage, and diagnostics shall be accessible.
- B. The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency, and motor voltage shall be listed on the drive identification portion of the LCD display.

2.9 OPERATOR CONTROLS

- A. The control power for the digital inputs and outputs shall be 24 Vdc.
- B. The internal power supply shall incorporate automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and will not be damaged if shorted.
- C. Input/Output connection terminals shall be used on all logic and analog signal connections in the power converter.
- D. Two voltage-free relay output contacts will be provided. One of the contacts will indicate the AC Drive detected fault status. The other contact shall indicate a drive run status.
- E. The combination enclosure shall have the following operator controls depending on the options selected:
- F. Hand-Off-Auto switch
- G. Speed potentiometer (located either in the door or in the power converter)
- H. AFC-Off-Bypass switch
- I. The combination enclosure shall include a terminal point connection for a fire/freezestat interlock, to prevent drive (or bypass) operation. The interlock must shut down the motor in both the drive and bypass modes.

2.10 DRIVE ISOLATION AND BYPASS CONTACTORS

- A. The AC Drive shall include electrically interlocked bypass and drive output contactors, circuit breaker disconnect, control circuit transformer, and AFC/OFF/BYPASS switch.
- B. The operator shall have full control of the bypass starter by operation of the AFC/OFF/BYPASS selector switch.
- C. In the AUTOMATIC mode of operation the bypass contactors shall be sequenced by the 120 V autostart contact provided by the user.
- D. The bypass contactor shall be de-energized to provide motor isolation during a drive ready state of operation.
- E. The drive output contactor shall be de-energized during drive bypass operation.

2.11 HARMONIC MITIGATION

- A. Each drive shall include a line reactor or DC bus choke to reduce power system harmonics and provide power quality protection for the internally or externally mounted drive,

PART 3 - INSTALLATION

3.1 INSPECTION

- A. Verify that the location is ready to receive work.

3.2 PROTECTION

- A. Before and during the installation, the AC Drive equipment shall be protected from water and site contaminants.

3.3 INSTALLATION

- A. Installation shall be in compliance with the manufacturer's instructions, drawings, and recommendations.
- B. The AC Drive supplier shall provide a representative to inspect the contractor's installation, and to test and start up the AC Drive(s) furnished under this specification.

3.4 TRAINING

- A. Training shall be offered by the AC Drive manufacturer. Please refer to Section 017900 Training and Demonstration.

END OF SECTION 262923

SECTION 264313 –SURGE PROTECTIVE DEVICES (TRANSIENT VOLTAGE SURGE SUPPRESSOR)

PART 1 - GENERAL

1.1 BRANCH PANEL DEVICES (SEPARATE DEVICE)

- A. These specifications describe the electrical and mechanical requirements for a high energy surge protective device system (abbreviated as TVSS or SPD in this specification and on all drawings). The specified system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Type 2, as tested by ANSI/IEEE C62.45. The system shall be connected in parallel with the protected system; no series connected elements shall be used, which could constitute a single point failure.

1.2 APPROVED MANUFACTURERS

- A. The basis for separately mounted units is Hubbell SPD and shall represent the minimum level of construction. GE Electrical Distribution & Control, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications. Other manufacturers shall submit for pre-approval and provide detailed compliance or exception statements to all provisions of this specification to allow consideration.
- B. The basis for integrally mounted units Square D Company Model IMA. GE Electrical Distribution & Control, and Siemens Energy & Automation, Inc. shall be permitted to bid these specifications. Other manufacturers shall submit for pre-approval and provide detailed compliance or exception statements to all provisions of this specification to allow consideration.

1.3 STANDARDS

- A. The specified system shall be designed, manufactured, tested and installed in compliance with:
 - 1. Canadian Standards Association (CSA)
 - 2. American National Standards Institute C62.41
 - 3. Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.1, C62.41, and C62.45)
 - 4. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
 - 5. National Electrical Manufacturer Association (NEMA) LSI-1992 Guidelines
 - 6. National Fire Protection Association (NFPA 20, 70, 75, and 78)
 - 7. Underwriters Laboratories (UL Standard 1449, UL Standard 1283)
 - 8. National Electrical Code – Article 285
- B. The system shall be UL listed as a complete system under UL 1449 Standard for Surge Protection Devices, Third Edition or Newer.

1.4 DESCRIPTION

- A. Provide Type 2 Surge Protection Devices (SPD) for the protection of AC electrical circuits formerly

knows as Transient Voltage Surge Suppression (TVSS) system. Provide high energy surge current diversion and be suitable for application in type 2 environments.

B. Modes of Protection:

Line to Ground, Line to Neutral and neutral to Ground for services with a neutral.
For Services without a neutral, Line to Line and Line to Ground.

A. Provide common and normal modes of protection.

1.2 QUALITY ASSURANCE

- A. The specified system shall be thoroughly factory-tested before shipment. Testing of each system shall include but shall not be limited to quality control checks, "Hi-Pot" tests at two times rated voltage plus 1000 volts per UL requirements, IEEE C62.41 Category B surge tests, UL ground leakage tests and operational and calibration tests.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Acceptable manufacturers:

1. APT
2. Hubbell
3. Current Technology
4. Liebert
5. Raycap

2.2 PERFORMANCE CHARACTERISTICS

- A. Response time: > 5 nanoseconds for all modes of protection.
- B. SPD shall bear the UL Mark and shall be Listed to third Edition of UL 1449. "Manufactured in accordance with" is not equivalent to UL Listing and does not meet intent of specification.
- C. Post SPD and performance parameters at www.UL.com under Category Code: VZCA. Products or parameter without posting at UL.com are not approved.
- D. Minimum surge current capacity for Service Entrance units based on 8 x 20 microsecond current waveform:
1. 200,000 amps between each phase for line-to-line mode
 2. 200,000 amps each phase for line-to-ground mode
 3. 200,000 amps each phase for line-to-neutral mode
 4. 200,000 amps for neutral-to-ground mode

- E. Minimum surge current capacity for panelboard units based on 8 x 20 microsecond current waveform:
 - 1. 100,000 amps between each phase for line-to-line mode
 - 2. 100,000 amps each phase for line-to-ground mode
 - 3. 100,000 amps each phase for line-to-neutral mode
 - 4. 100,000 amps for neutral-to-ground mode
- F. Sequential Surge Current Survivability:
 - 1. 1,000 sequential category surges without failure.
- G. Current Rating:
 - 1. Rated for continuous current and AIC rating of equipment protected.

2.3 OPERATING CONDITIONS

- A. Temperature range: -40°C to +50°C (-40°F to 122°F).
- B. Relative humidity range: 0 to 95%, non-condensing.
- C. Audible noise level: > 40 dBA at 5 ft.

2.4 SPD FABRICATION:

- A. SPD Modules:
 - 1. UL Labeled as Type 2 (verifiable at www.UL.com), intended for use without need for external or supplemental overcurrent controls. Protect suppression component of every mode, including N-G, by internal overcurrent and thermal overtemperature controls. SPDs relying on external or supplementary installed safety disconnects do not meet the intent of specifications.
 - 2. UL Labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
 - 3. Suppression components: Heavy-duty MOVs, selenium cells, or combination of both.
 - 4. Provide surge current diversion paths for all modes of protect: L-N, L-G, N-G in Wye systems, and L-L, L-G in delta systems.
 - 5. Provide service entrance SPD audible diagnostic monitoring by way of audible alarm.
 - 6. Provide service entrance SPD with 1 set of NO/NC dry contacts for alarm conditions.
 - 7. Provide visual LED diagnostics including a minimum of 1 green LED indicator per phase, and 1 red service LED. Include an audible alarm with on/off silence function and diagnostics test function (excluding branch).
 - 8. If a dedicated breaker for the SPD is not provide in the switchboard, include an integral UL Recognized disconnect switch. Dedicated breaker to serve as means for disconnect for distribution SPDs.

9. Meet or exceed the following criteria:
10. UL 1449 Listed Voltage Protection Ratings (VPRs) for 6kV 3000A testing as follows:

Voltage	L-N, L-G, N-G	L-L
240V/120V	650-800V	650-800V
480Y/277V	1100-1300V	1900-2100V

UL 1440 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
240V/120V	15%	140V
480Y/277V	15%	320V

Provide a serviceable, replaceable modules (excluding Branch).

Provide warranty for a period of 10 years, incorporating unlimited replacement of suppressor parts if they are destroyed by transients during the warranty period.

A. Service Entrance:

1. Install 1 primary suppressor external to the service entrance in accordance with manufacturer instructions.
2. Install SPD on line or load side.
3. Bond SPD ground to service entrance ground.

B. SPD Performance Interconnect Cable (DPI):

1. Provide dual-shielded triple insulated multi-core power conductor cable specifically listed for SPD installations.
2. Provide Low impedance approximately 25% of conventional pipe and wire for improved clamping voltage.

PART 3 - EXECUTION

3.1 APPLICATION OF SPD

- A. Provide UL-approved disconnect switch at Service Entrance or Transfer Switch as a means of service disconnect if a 60A breaker is not available.
- B. Provide independent means of servicing disconnect at Branch Panelboards such that the protected panel remains energized. A 30A breaker (or larger) may serve this function (for non-integral TVSS panelboards).

3.2 INSTALLATION

- A. Installation shall be in strict accordance with manufacturer's recommendations.

- B. Unit shall be installed within 2'-0" of panel with straight wiring connection. Manufacturer-approved cables may be used that allow conductor length to extend beyond 2'-0" in length without affecting capability of unit.
- C. Input conductors twisted together to reduce inductance.
- D. Avoid 90-degree bends in cable.

3.3 QUALITY ASSURANCE

- A. Factory test system prior to shipment. Include quality control check, "Hi-Pot" test at 2 times rated voltage plus 1,000 volts, ground leakage tests, and calibration.

3.4 WARRANTY

- A. Provide 10-year manufacturer warranty.

END OF SECTION 264313

SECTION 265113 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the light fixtures as specified. Material, equipment or services necessary to complete the installation of these fixtures, but not specifically mentioned shall be furnished as though specified.
- B. It shall be the duty of the Contractor to check the following fixtures carefully against the wiring plans, and furnish a unit of proper size and type.
- C. The manufacturer and number listed in these specifications establish type and quality. Fixtures of similar manufacturer must be pre-approved by the Engineer/Lighting Designer prior to bidding.
- D. The contractor shall provide a Lighting control System including lamps/ballasts that meets all performance requirements in accordance with approved plans and specifications.
- E. The “Lighting control system” as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls, architectural dimming controls, and lamps/ballasts.

1.2 BALLAST WARRANTY

- A. Electronic ballasts shall be provided with a 5 year warranty. If the ballast fails within the warranty period, the ballast manufacturer will provide replacement ballast free of charge and shall provide a labor allowance to cover the cost of ballast installation. This warranty shall be provided direct to the Owner.

1.3 FIXTURE PACKAGING

- A. Packaging of fixtures for the purpose of reducing cost or reducing the burden on manufacturer’s agents, distributors, or contractors shall not be permitted. Contractor shall obtain from manufacturer and distributor unit pricing for each fixture for inspection by Engineer/Lighting Designer. Failure to comply with written specifications shall hold the contractor financially responsible for providing specified fixtures to the Project.

PART 2 - PRODUCTS

2.1 LAMPS

- A. Lamps shall be provided by the electrical contractor with sizes as indicated on the drawings. Lamps shall be as manufactured by Philips Lighting Company or approved equal Sylvania or General Electric.

2.2 BALLASTS

- A. All indoor LED fixtures shall be furnished with OsramQuicktronic, Philips, Lutron, or equal, Octron compatible instant start, high frequency electronic ballasts with less than 10% harmonic distortion, minimum 97% power factor , minimum of .88 Ballast Factor in 120 or 277 volt as required by system voltage.

2.3 LIGHT FIXTURES

- A. Light fixtures shall be as scheduled on plans. Refer to sheet E-102.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install light fixtures at locations and heights as indicated and in accordance with fixture manufacturer's instructions.
- B. Install fixtures as recommended by the manufacturer, or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures suspended in continuous rows.
- C. Where surface mounted fixtures are indicated for installation on ceilings made of combustible materials, provide 1½" ceiling spacers, unless the fixture is UL approved for mounting directly to the ceiling material.
- D. Properly support and align all fixtures and provide all necessary steel shapes for support of the fixtures. Fixtures recessed in ceilings shall be securely connected to the ceiling. For fixtures weighing less than 56 pounds, provide a minimum of two (2) 12 gauge wires which are connected to the structure above. These wires are to be extended and attached to the light fixture and may be slack. Fixtures weighing more than 56 pounds shall be supported directly from the structure above. Coordinate complete fixture installation with the building construction.
- E. Where LED units are shown installed end to end, provide suitable connectors or collars to connect adjoining units to appear as a continuous unit.
- F. All LED fixtures shall be provided with T-bar clips, snap on type. Manufacturers with integral clips, in compliance with National Electrical Code requirements, will be acceptable.

3.2 G. COORDINATION

- A. Refer to Architectural drawings for exact fixture locations.
- B. Coordinate the installation and location of light fixtures with other work and all other trades before installation to avoid conflicts. Light fixture locations in mechanical rooms shall be coordinated with final installed piping and ductwork layouts.
- C. Unless otherwise indicated, square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines.
- D. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling installer in regards to the location and installation of light fixtures.

3.3 WALL MOUNTED FIXTURES

- A. All wall mounted fixtures shall be coordinated with the architectural features of the building. Where specific elevations or dimensions are not indicated, verify the correct location with the Architect prior to beginning any work.
- B. Unless otherwise noted, all conduit and back boxes for wall mounted fixtures shall be concealed.

3.4 MULTI-LEVEL SWITCHING

- A. The lighting design for this project may include multi-level (inboard/outboard) switching. Where

indicated, 3 lamp fixtures shall have the center lamp switched from one switch and the outer 2 lamps switched from another switch.

- B. Where indicated, 4 lamp fixtures shall have the outer 2 lamps switched from one switch and the center 2 lamps shall be switched from another switch.
- C. Fixtures indicated to have multi-level switching shall be furnished with the proper number of ballasts.

3.5 ADJUSTING

- A. Adjust all fixture sockets to match the lamp specified and aim all adjustable fixtures as directed by the Architect.
- B. Upon completion of the installation of light fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- C. Clean light fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.
- D. At the time of substantial completion, aim all track lights, flood lights, spot lights, etc per the Architect's direction. Provide all scaffolds, lifts etc as required.
- E. At the time of final acceptance of this project by the Owner, all lamps shall be in working order and all fixtures shall be fully lamped.

END OF SECTION 265113

SECTION 265613 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide the light fixtures as specified. Material, equipment or services necessary to complete the installation of these fixtures, but not specifically mentioned shall be furnished as though specified.
- B. It shall be the duty of the Contractor to check the following fixtures carefully against the wiring plans, and furnish a unit of proper size and type.
- C. The manufacturer and number listed in these specifications establish type and quality. Fixtures of similar manufacturer must be pre-approved by the Engineer/Lighting Designer prior to bidding.
- D. The contractor shall provide a Lighting control System including lamps/ballasts that meets all performance requirements in accordance with approved plans and specifications.
- E. The “Lighting control system” as referred to in this section of the specifications shall include the following subsystems and components of the subsystems: occupancy sensors, time sweep controls, daylighting controls, architectural dimming controls, and lamps/ballasts.

1.2 BALLAST WARRANTY

- A. Electronic ballasts shall be provided with a 5 year warranty. If the ballast fails within the warranty period, the ballast manufacturer will provide replacement ballast free of charge and shall provide a labor allowance to cover the cost of ballast installation. This warranty shall be provided direct to the Owner.

1.3 FIXTURE PACKAGING

- A. Packaging of fixtures for the purpose of reducing cost or reducing the burden on manufacturer’s agents, distributors, or contractors shall not be permitted. Contractor shall obtain from manufacturer and distributor unit pricing for each fixture for inspection by Engineer/Lighting Designer. Failure to comply with written specifications shall hold the contractor financially responsible for providing specified fixtures to the Project.

PART 2 - PRODUCTS

2.1 LAMPS

- A. Lamps shall be provided by the electrical contractor with sizes as indicated.

2.2 BALLASTS

- A. All LED fixtures shall be furnished with OsramQuicktronic, Philips, Lutron, or equal, Octron compatible solid state ballast with less than 20% harmonic distortion, minimum 97% power factor and minimum starting temperature of -18C (0F) in 120 or 277 volt as required by system voltage.

2.3 LIGHT FIXTURES

- A. Light fixtures shall be as scheduled on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install light fixtures at locations and heights as indicated and in accordance with fixture manufacturer's instructions.
- B. Install fixtures as recommended by the manufacturer, or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures suspended in continuous rows.
- C. Where surface mounted fixtures are indicated for installation on ceilings made of combustible materials, provide 1½" ceiling spacers, unless the fixture is UL approved for mounting directly to the ceiling material.
- D. Properly support and align all fixtures and provide all necessary steel shapes for support of the fixtures. Fixtures recessed in ceilings shall be securely connected to the ceiling. For fixtures weighing less than 56 pounds, provide a minimum of two (2) 12 gauge wires which are connected to the structure above. These wires are to be extended and attached to the light fixture and may be slack. Fixtures weighing more than 56 pounds shall be supported directly from the structure above. Coordinate complete fixture installation with the building construction.
- E. All fluorescent fixtures shall be provided with T-bar clips, snap on type. Manufacturers with integral clips, in compliance with National Electrical Code requirements, will be acceptable.

3.2 COORDINATION

- A. Refer to Architectural drawings for exact fixture locations.
- B. Coordinate the installation and location of light fixtures with other work and all other trades before installation to avoid conflicts.
- C. Unless otherwise indicated, square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines.
- D. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling installer in regards to the location and installation of light fixtures.

3.3 WALL MOUNTED FIXTURES

- A. All wall mounted fixtures shall be coordinated with the architectural features of the building. Where specific elevations or dimensions are not indicated, verify the correct location with the Architect prior to beginning any work.
- B. Unless otherwise noted, all conduit and back boxes for wall mounted fixtures shall be concealed.

3.4 ADJUSTING

- A. Adjust all fixture sockets to match the lamp specified and aim all adjustable fixtures as directed by the Architect.
- B. Upon completion of the installation of light fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- C. Clean light fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.
- D. At the time of substantial completion, aim all flood lights, spot lights, etc per the Architect's direction. Provide all scaffolds, lifts etc as required.
- E. At the time of final acceptance of this project by the Owner, all lamps shall be in working order and all fixtures shall be fully lamped.

END OF SECTION 265613

SECTION 312000 - EARTH MOVING

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. Preparing subgrades for walks and pavements.
 - 2. Subbase course for concrete walks and pavements.
 - 3. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.

- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Construction Activity Pollution Prevention: Please see Sheet C-105 Erosion Control Plan

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
- B. Utility Locator Service: Notify Dig Safe System for area where Project is located before beginning earth moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- H. Sand: ASTM C 33; fine aggregate.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Grab Tensile Strength: 157 lbf; ASTM D 4632.

2. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 3. Tear Strength: 56 lbf; ASTM D 4533.
 4. Puncture Strength: 56 lbf; ASTM D 4833.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 2. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 3. Tear Strength: 90 lbf; ASTM D 4533.
 4. Puncture Strength: 90 lbf; ASTM D 4833.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 6 inches outside of minimum required dimensions of concrete cast against grade.

- b. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- c. 6 inches beneath pipe in trenches.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 1% below and 3% above optimum moisture content.
 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3% and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of walls to required elevations, and uniformly along the full length of each wall.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Walks: Plus or minus 1 inch
 2. Pavements: Plus or minus 1/2 inch
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase course and base course to required and cross-slope grades.
 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material and maximum lift thickness comply with requirements.
 - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312316 - EXCAVATION FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavating for volume below grade, building volume below grade, footings, slabs-on-grade, paving, and site structures.

1.2 RELATED REQUIREMENTS

- A. Section 017000 - GENERAL REQUIREMENTS FOR SPRAY GROUNDS: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.
- B. Section 312000 - Earth Moving
- C. Section 312323 - FILL AND BACKFILL FOR SPRAY GROUNDS: Fill materials, backfilling, and compacting.
- D. Section 33 46 10 - SUBDRAINAGE FOR SPRAY GROUNDS: Filter aggregate and filter fabric for foundation drainage systems.

1.3 PROJECT CONDITIONS

- A. Protect plants, lawns, rock outcroppings, and other features to remain.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 312000 for topsoil removal.
- C. Locate, identify, and protect utilities that remain and protect from damage.

- D. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Engineer.

3.2 EXCAVATING

- A. Classification of Excavated Materials: No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.
- B. Blasting: Blasting or other use of explosives for excavation will not be permitted.
- C. Excavate to accommodate new structures and construction operations.
- D. Notify Engineer in writing of unexpected subsurface conditions. Do not further disturb such condition or perform any Work in connection therewith until receipt of written order to do so.
- E. Design any excavation slopes or temporary shoring.
- F. Slope height, slope inclination, and excavation depths, including utility trench excavations, should in no case exceed those specified in federal, state, or local safety regulations, such as OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations.
- G. Do not interfere with 45 degree bearing splay of foundations.
- H. Dewatering:
 - 1. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work.
 - 2. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
 - 3. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation. For Contractor's convenience and at Contractor's cost, Contractor may stabilize saturated soils using means other than dewatering, with prior approval of Engineer. Other methods may include over-excavation and/or application of fill materials. Under no circumstance shall Contractor employ fill materials that results in open voids in the subgrade, which could be later filled in with silts and fines causing settlement of the subgrade.

4. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.
 5. The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.
- I. Provide temporary means and methods, as required, to remove all water from excavations until directed by Engineer. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.3 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces by Engineer before placement of foundations.

3.4 PROTECTION

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SPEC SECTION 312316

SECTION 312323 - FILL AND BACKFILL FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Filling, backfilling, and compacting for volumes below grade, building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

1.2 RELATED REQUIREMENTS

- A. Section 131115 - Cast in place concrete for spray grounds
- B. Section 312000 - Earth Moving
- C. Section 334610 - Subdrainage for spray grounds

1.3 REFERENCE STANDARDS

- A. ASTM C 33 - Standard Specification for Concrete Aggregates; 1999a.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- F. ASTM D 4253 - Standard Test Methods for Maximum Index Density and Unit Weight Soils Using a Vibratory Table; 2000.
- G. ASTM D 4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density; 2000.
- H. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2009.
- I. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.
- J. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Soil Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- E. Compaction Density Test Reports.
- F. Testing shall be completed by an independent testing agency and shall be less than 12 months old. The costs for material tests shall be paid for by the Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide sufficient quantities of fill to meet project schedule and project requirements. When necessary, store materials on site in advance of need.
- B. When fill materials are stored on site:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General Fill: Imported borrow meeting all of the following requirements:
 - 1. Free of lumps larger than 3 inches, rocks larger than 2 inches, organics and debris.
 - 2. Conforming to ASTM D 2487 Group Symbol SC, CL, ML, SM, or GC.
- B. Structural Fill: Imported borrow meeting all of the following requirements:

1. Free of lumps larger than 1.5 inches, rocks larger than 1.5 inches, organics, and debris.
 2. Fill shall consist of low-plasticity cohesive material or granular material containing at least 18 percent fines.
 3. Low-plasticity cohesive fill shall have a liquid limit (LL) less than 40 and a plasticity index (PI) between 10 and 20 in accordance with ASTM D 4318 by the wet preparation method.
 4. Conforming to ASTM D 2487 Group Symbol CL.
- C. Concrete for Fill: See Section 033000; compressive strength of 2,500 psi.
- D. Granular Fill: Granular fill for compacted backfill shall be free-draining, poorly graded, clean, angular crushed stone; free of shale, clay, friable material and debris.
1. Gradation: Comply with ASTM C 33, Table 2 Grading Requirements for Coarse Aggregate, size No. 57 or 67 aggregate.
 2. The fraction passing the No. 200 sieve shall not exceed 5 percent.
- E. Underdrain Aggregate - Pea Gravel : Natural stone; washed, free of clay, shale, organic matter.
1. Graded in accordance with ASTM C 136, within the following limits:
 - a. Minimum Size: 3/8 inch.
 - b. Maximum Size: 3/4 inch.
- F. Topsoil: See Section 312200.

2.2 ACCESSORIES

- A. Geotextile Fabric:
1. Manufacturers and products:
 - a. Contech C60NW.
 - b. Propex Geotex 601.
 - c. Mirafi 160N.
 2. Properties:
 - a. Tensile Strength (Grab), ASTM D 4632: 160 lbs.

- b. Apparent Opening Size, ASTM D 4751: 70 US Standard Sieve.
- c. Water Flow Rate, ASTM D 4491: 110 gpm/sq. ft.

2.3 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. All fill materials shall be approved by Engineer.
- C. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance . The costs for material tests shall be paid for by the Contractor.
- D. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 312200 for additional requirements.
- C. Verify subdrainage, piping, dampproofing, or waterproofing installation has been inspected.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.
- E. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

- A. Proof roll subgrade surface with a loaded tandem-axle dump truck, with a minimum gross weight of 25 tons, to identify soft spots. Construction equipment equipped with flotation tires, such as scrapers, skid-steers, and pay loaders, are not suitable for use in proof rolling.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill.
- C. In areas to accept fill, the top 10 inches of the ground surface shall be scarified, moisture conditioned to -1 to 3 percent of the material's optimum moisture content. The scarified soils should then be recompacted to at least 95 percent of the material's standard Proctor dry density (ASTM D 698).

- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. In areas where a finer material is placed over or beside a coarser material and migration of one into the other can occur, such as when structural fill, general fill, or topsoil is placed over or beside granular fill, geotextile fabric shall be placed over or beside the granular fill or coarser material to separate the fill materials and prevent migration.
- F. Fill at Walls: Carefully place and compact fill materials along walls in order to protect piping and conduit from damage due to material and equipment loading.
- G. Upon completion of excavation and filling operations, care shall be taken to prevent subgrade disturbance and maintain the subgrade moisture content prior to construction of foundations and slabs. If the subgrade becomes saturated, desiccated, or disturbed, the affected material shall be removed and replaced, or these materials shall be scarified, moisture-conditioned as necessary, and recompacted prior to construction of foundations or slabs. If two (2) days elapses or a significant weather event occurs between subgrade preparation and further construction, subgrades shall be retested prior to placement of structures.
- H. Compaction Method:
 - 1. The method of compaction and the equipment used shall be appropriate for the material to be compacted and the work location.
 - 2. Sheep's foot roller, smooth drum rollers, pneumatic tired rollers, jumping jacks, vibratory equipment, small rollers, tampers, or other appropriate equipment shall be used for compaction.
 - 3. Compaction using loaded trucks, bulldozer tracks, backhoe buckets, or similar construction equipment shall not be allowed.
- I. Moisture content, at the time of compaction, shall be controlled to between 1 percent below and 3 percent above the optimum moisture content.
- J. For cohesionless fill materials, where the percent passing the No. 200 sieve is less than 10 percent and the moisture-density curve indicates only slight sensitivity to changing

moisture content, compaction requirements should be changed to 75 percent relative density as determined by ASTM D 4253 and ASTM D 4254.

K. General Fill:

1. Deposit in uniform layers not exceeding 8 inches in uncompacted thickness.
2. Compact to 95 percent of maximum density at 1 percent below and 3 percent above the optimum moisture content, as determined by ASTM D 698 when that test is appropriate.

L. Structural Fill:

1. Deposit in uniform layers not exceeding 8 inches in uncompacted thickness.
2. Compact to 98 percent of maximum density at 1 percent below and 3 percent above the optimum moisture content, as determined by ASTM D 698 when that test is appropriate.

M. Granular Fill:

1. Granular material shall be deposited in uniform layers not exceeding 8 inches in uncompacted thickness.
2. The granular backfill shall be compacted with a suitable vibratory roller or platform vibrator to at least 98 percent of the materials standard Proctor dry density (ASTM D 698).

N. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

O. Correct areas that are over-excavated.

1. Load-bearing foundation surfaces: Fill with concrete.
2. Other areas: Use structural fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

P. Reshape and re-compact fills subjected to vehicular traffic.

Q. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.4 FILL AT SPECIFIC LOCATIONS, UNLESS NOTED OTHERWISE ON DRAWINGS

A. General Fill: Use in landscape areas only.

- B. Structural Fill: Use under all structures, where indicated, including but not necessarily limited to, slabs-on-grade, footings, and foundations.
- C. Granular Fill: Use under all structures and at all other locations where indicated on the Drawings.
- D. Underdrain Aggregate: Use for the subdrainage system only.
- E. Buried Conduits and Piping in Trenches :
 - 1. Where pipe or conduit is not located under a structure:
 - a. Bedding: Use granular fill up to top of pipe or conduit.
 - b. Cover with general fill.
 - c. Fill up to subgrade elevation.
 - 2. Where pipe or conduit is located under a structure:
 - a. Bedding: Use granular fill up to top of pipe or conduit.
 - b. Place separation geotextile fabric over granular fill.
 - c. Cover with structural fill.
 - d. Fill up to subgrade elevation.

3.5 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations, unless noted otherwise on the drawings.

3.6 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: As noted below unless requested otherwise by Engineer.

1. All Areas Except Under Pavements:
 - a. Fill Materials: At least one (1) test per fill type per 1,000 cubic yards of fill placed. Each test shall include sieve, P.I., and moisture density relationship when appropriate for the fill type. Provide other testing required to determine conformance.
 - b. Compaction: At least one (1) field density test for each 2,000 square feet of fill lift, but no less than three (3) tests per lift.
 2. Under Pavements:
 - a. Fill Materials: At least one (1) test per fill type per 2,500 cubic yards of fill placed. Each test shall include sieve, P.I., and moisture density relationship when appropriate for the fill type. Provide other testing required to determine conformance.
 - b. At least one (1) field density test per 5,000 square feet of fill lift, but no less than three (3) tests per lift.
- F. Backfill operations shall be monitored full time by the testing and inspection agency.
- G. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

3.7 CLEANING

- A. See Section 017400 - Cleaning, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SPEC SECTION 312323

SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: temporary and permanent management practices as shown on the project drawings, and indicated in the Storm Water Pollution Prevention Plan (SWPPP), and as directed by the Owner during the life of the Contract to control erosion, storm water runoff, and sedimentation.
- B. Coordinate temporary erosion control provisions with permanent erosion control features to assure economical, effective, and continuous erosion, sedimentation, and pollution control throughout the construction and stabilization period.
- C. Management practices required are not limited to the measures shown on the project drawings and indicated on the SWPPP. Provide additional practices necessitated by actual conditions and methods.
- D. Silt and pollution leaving the site and any effects of the release are the sole and total responsibility of the Contractor as Primary, Secondary, or Tertiary Permittee or Operator.
- E. Provide Subcontractors with a copy of the Erosion Control Plan and the SWPPP. Post notices requiring Subcontractors to review and comply with the Erosion Control Plan and the SWPPP.

1.2 RELATED DOCUMENTS

- A. Conform to the Federal Clean Water Act, as well as the State clean water and erosion control regulations, and the rules and regulations promulgated to each of these Acts.

1.3 DEFINITIONS

- A. This partial list of definitions is provided for the Contractor's convenience only. Obtain copies of the reference documents and learn appropriate terms required to fully implement the Erosion Control Plan and SWPPP.
- B. Terms Defined:
 - 1. Best Management Practices (BMPs): Schedules of activities, prohibitions or practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State and/or the United States of America. BMPs include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
 - 2. General Contractor: The operator of the common development or site.

3. Nephelometric Turbidity Unit (NTU): A numerical unit of measure based upon photometric analytical techniques for measuring the light scattered by fine particles of a substance in suspension.
4. NPDES: National Pollution Discharge Elimination System.
5. Operator: The entity that has the primary day-to-day operational control of those activities at the facility necessary to ensure compliance with Erosion Control Plan and SWPPP requirements and permit conditions.
6. Primary Permittee: The Owner and the operator of a tract of land for a common development, or of a stand-alone facility that is not part of a common development; or a utility company when it is the only entity conducting a construction activity on a piece of property.
7. Qualified Personnel: A person who has successfully completed an erosion and sediment control short course eligible for continuing education units, or an equivalent course approved by EPD and the State Soil and Water Conservation Commission.
8. Sediment: Solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its site of origin by, wind, water, ice, or gravity as a product of erosion.
9. Waters of the State: Rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, wetlands, and other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the state which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

1.4 QUALITY ASSURANCE CRITERIA

- A. Project Review: Prior to the preconstruction conference, the Contractor shall review in detail the Erosion Control Plan and the SWPPP.
- B. Preconstruction Conference: At the preconstruction conference, submit for acceptance a detailed schedule for accomplishment of temporary and permanent erosion control work and installation of BMPs, for clearing and grubbing, grading, construction, paving, and other project activities. Submit for acceptance a proposed method of erosion control for haul roads and borrow pits and a plan for disposal of waste material. Do not begin work until the erosion control schedules and methods of operations have been accepted by the Owner.
- C. Provide qualified personnel to supervise provision and maintenance of management practices.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Silt Socks

1. Silt Sock shall be SiltSoxx® by Filtrexx® or approved equal.
2. BioD-Watl Fiber Roll by Rolanka or approved equal.
3. Futerra F4 Netless Rolled Erosion Control Product by Profile Products LLC or approved equal.

B. Polymers

1. Anionic polyacrylamide soil binding agents, environmentally benign, 0.05% monomer by weight.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install BMPs in accordance with the Erosion Control Plan and SWPPP.
- B. Maintain BMPs throughout construction and until the site is finally stabilized.
- C. Implement or assist the Owner with implementation of the SWPPP.
- D. Submit reports as required by the local jurisdiction, state, and federal government.
- E. Retain records as required by local, state, and federal authorities.
- F. Submit or assist the Owner with submittals of applicable permits and termination of permits.

3.2 SCHEDULE

- A. Temporary construction entrance(s), silt fences, straw bale dikes, or other initial sediment controls shown on the project drawings must be installed prior to any other work.

3.3 METHODS

- A. Several methods of controlling dust and other pollutants include, but are not limited to, the following:
 1. Exposing the minimum area of erodible earth.
 2. Applying temporary mulch with or without seeding.
 3. Using water sprinkler trucks.
 4. Using covered haul trucks.
 5. Using dust palliatives or penetration asphalt on haul roads.
 6. Using plastic sheet coverings.
 7. Using gravel.

3.4 AUTHORITY OF ENGINEER

- A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, and borrow and fill operations.

- B. The Engineer has the authority to direct the Contractor to provide immediate permanent or temporary erosion control measures to minimize loss of soil due to erosion and contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.

3.5 CONSTRUCTION

- A. Prior to clearing and grubbing operations for the project. Contractor shall identify all areas where the potential for loss of soil due to erosion exists, and shall line the downhill side of the construction site within these areas with straw bales or silt fences to minimize eroded materials from leaving the site. These shall be maintained throughout the construction period and removed when the permanent ground covering is established.
- B. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available.
- C. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- D. When erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.
- E. The Contractor will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. If disturbance occurs outside scheduled areas or anticipated work zones, or if weather conditions delay permanent control measures, temporary erosion control measures shall be taken immediately.

3.6 MAINTENANCE

- A. Maintain temporary management practices until no longer needed or permanent management practices are provided and the site is stabilized. Remove temporary materials.
- B. In the event that temporary management practices are required due to negligence, carelessness, or failure to provide permanent management practices as a part of work as scheduled, provide at no cost to the Owner.

END OF SECTION 312500

SECTION 321100 - CAST-IN-PLACE CONCRETE FOR SITEWORK

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
1. Roads, parking lots, sidewalks, curbs and gutters, etc.
 2. Sanitary Structures, Wet Wells, Valve Vaults, Meter Pits, etc.

1.2 RELATED SECTIONS

- A. 312000 Earth Moving

1.3 REFERENCES

- A. American Concrete Institute:

1. ACI 301 Specifications for Structural Concrete
2. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305R Hot Weather Concreting
4. ACI 306R Cold Weather Concreting
5. ACI 306.1 Standard Specification for Cold Weather Concreting
6. ACI 308 Standard Practice for Curing Concrete
7. ACI 347 Guide to Formwork for Concrete

- B. American Society for Testing & Materials:

1. ASTM B 221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
2. ASTM C 33 Concrete Aggregate
3. ASTM C 94 Ready-Mixed Concrete
4. ASTM C 150 Portland Cement
5. ASTM C 260 Air Entraining Admixtures for Concrete
6. ASTM C 494 Chemicals Admixtures for Concrete
7. ASTM C 595M Blended Hydraulic Cements (Metric)
8. ASTM C 1017 Chemical Admixtures for Use in Producing Flowing Concrete
9. ASTM C 1107 Packaged Dry, Hydraulic Cement Grout (Nonshrink)
10. ASTM D 994 Performed Expansion Joint Filler for Concrete
11. ASTM D 1190 Concrete Joint Sealer, Hot-Poured Elastic Type
12. ASTM D 1751 Preformed Expansion Joint Filler for Concrete Paving
13. ASTM D 1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings: Steel Reinforcement Shop Drawings, placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Submit a Joint Plan, showing type and location, no smaller than the scale of the project drawings. Joint Details, including dowels, where appropriate. Sealer manufacturer's information.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: a qualified installer who employs on the project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent agency to be hired by owner, acceptable to authorities having jurisdiction and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade I. Testing Agency laboratory supervisor shall be and ACI-certified Concrete Laboratory Testing Technician – Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from a single manufacturer.
- E. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on shop drawings.
- B. Store reinforcement at the job site in a manner to prevent damage and accumulation of dirt and excessive rust.
- C. Handle reinforcement in such a way to prevent bending and damage.

PART 2 – PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and High-density overlay, Class 1 or better.
 - B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
 - C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist concrete loads without detrimental deformation.
 - D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
 - E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
 - F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- A. Revise three subparagraphs below to suit Project; delete if not required.
- 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: Comply with ASTM A 305, Deformed Bars. Conforming to ASTM 615, Grade 60, or ASTM 706, Grade 60 as indicated on the project drawings.
- B. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
- C. Plain Steel Wire: ASTM A 82, as drawn.
- D. Plain Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, grade 60, plain steel bars, cut true to length with ends square and free of burrs.
- B. Supports for Reinforcement: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than the concrete as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.

2.4 MATERIALS

- A. Cementitious Materials:
 - 1. Cement shall be a standard brand Portland cement which shall conform to ASTM C 150. Type I cement with Fly Ash conforming to ASTM C 618, Class F.
 - 2. Use cement of the same type, brand, and source throughout the project.
- B. Water: ASTM C 94/C 94M and potable.
- C. Fine Aggregate:
 - 1. Fine Aggregate shall consist of natural sand, manufactured sand, or a combination thereof. The gradation requirements of fine aggregate shall be as follows: 100 percent passing the 3/8 inch sieve, 95-100 percent passing the No. 4 sieve, 40-80 percent passing the No. 16 sieve, 5-30 percent passing the No. 50 sieve, and 0-10 percent passing the No. 100 sieve.
 - 2. Fine Aggregate shall conform to the requirements of ASTM C 33 with respect to deleterious substances, soundness, and abrasion.

D. Course Aggregate:

1. Course Aggregate shall consist of crushed stone or crushed gravel of uniform quality. The gradation requirements of course aggregate shall be as follows: 100 percent passing the 1 inch sieve, 90-100 percent passing the 3/4 inch sieve, 40-60 percent passing the 1/2 inch sieve, 10-30 percent passing the 3/8 inch sieve, and 0-5 percent passing the No. 4 sieve.
2. Course Aggregate shall conform to the requirements of ASTM C 33 with respect to deleterious substances, soundness, and abrasion.

E. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.
2. Chemical:
 - a. ASTM C 494 Type A – Water Reducing
 - b. ASTM C 494 Type B – Retarding
 - c. ASTM C 494 Type C – Accelerating
 - d. ASTM C 494 Type D – Water Reducing and Retarding
 - e. ASTM C 494 Type E – Water Reducing and Accelerating
 - f. ASTM C 494 Type F – Water Reducing, High Range
 - g. ASTM C 494 Type G – Water Reducing, High Range and Retarding
3. Plasticizing: ASTM C 1017.
4. Use only admixtures that have been tested and accepted in mix designs and with Engineer's approval.
5. Comply with ACI 212.1 R "Admixture for Concrete" and ACI 212.2R-81 "Guide for Use of Admixture in Concrete."

F. Waterstops

1. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - i. Greenstreak.
 - ii. Williams Products, Inc.
 - iii. WARCO
 - b. Profile: Flat dumbbell without center bulb.
 - c. Dimensions: 4 inches by 3/16 inch thick, nontapered.

G. Curing Materials:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

4. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; AQUA KURE - CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - l. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.
 - n. SpecChem, LLC; Spec Rez Clear.
 - o. Symons by Dayton Superior; Resi-Chem Clear.
 - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

H. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

I. Contractor Joint Sealing Compound shall be one of the following:

1. Cold pour polymer fortified crack fill material generally conforming with ASTM D 1190.
2. Hot pour polymer rubber asphalt sealer meeting the requirements of ASTM D 3405. A certification will be required from the Contractor certifying that the joint sealer meets this specification.

J. Accessories:

1. Vapor Retarder: 10-mil thick clear polyethylene film/mildew resistant, type recommended for below grade application. Overlap (8 inch min.) and watertight-seal all joints.
2. Non-Shrink Grout: CDC-C 588, factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,000 psi in 48 hours and 7,000 psi in 28 days.
3. Non-Shrink Grout, Non-Metallic Grout: Factory premixed grout conforming to CRD-C-621-80, "Corps of Engineers Specification for Non-Shrink Grout."
 - a. Acceptable Manufacturers:
EUCO NS, The Euclid Chemical Company
SonogROUT, Sonneborn-Contech
Masterflow 713, Master Builders
DuragROUT, L & M Construction Chemical Co.

2.5 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows: Fly Ash: 20 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- E. Use admixtures according to manufacturer's written specifications.

2.6 CONCRETE MIXTURES

A. Roads, Parking Lots, Sidewalks, Curbs & Gutters:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum Water-Cementitious Material Ratio: 0.45.

3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: Between 5 and 7 percent at point of delivery.

B. Sanitary Structures, Wet Wells, Valve Vaults, Meter Pits, etc.:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum Water-Cementitious Material Ratio: 0.44.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: Between 5 and 7 percent at point of delivery.

2.7 FABRICATING REINFORCEMENT

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

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 degrees F (29.4 and 32.2 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F (32.2 degrees C), reducing mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the work, indicating project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in the project.

PART 3 – EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain framework according to ACI 301 and ACI 347.
- B. Limit concrete surface irregularities, the maximum deviation of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from planned alignment.
- C. Construct forms tight enough to prevent loss of concrete mortar. Retighten forms and bracing before placing concrete, as required, to prevent concrete mortar leaks and maintain proper alignment.

- D. Fabricate forms for easy removal without hammering or prying against inner surfaces. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- F. Forms shall have a depth equal to greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section or form shall be uniform and free from undesirable bends or warps.
- G. Every ten (10) foot length of form shall have at least three (3) form braces which shall be spaced at intervals of not more than five (5) feet, having the end brace not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

3.2 REMOVING AND REUSING FORMS

- A. General: Formwork may be removed after concrete has achieved at least 70 percent of its 28-day design compressive strength. Concrete has to be hard enough to not be damaged by form removal operations and curing and protection operations as outlined below.
- B. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.3 VAPOR RETARDERS & BARRIERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and fully seal with manufacturer's recommended tape.
 - 2. Tape around all penetrations & lap edges up over top of foundation wall a min. of 4".
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.4 STEEL REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
- F. The maximum angle bar that is intended to be straight may be bent or offset shall be at a slope of 6:1, longitudinal to transverse dimension.
- G. If clearances for reinforcing require hooks shorter than standard hooks, fabricator shall be responsible for providing shorter hooks, as required to meet ACI requirements.
- H. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheets widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 CONCRETE PLACEMENT, GENERAL

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and subgrade preparation are complete and that required inspections and tests have been performed.
- B. Do not add water to concrete during delivery, at project site, or during placement operations unless approved by the Engineer.
- C. Before test sampling and placing concrete, water may be added at the project site, subject to the limitations of ACI 301.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be place continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed pavement surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces as required in project drawings.
 - 5. Limit durations of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 degrees F (4.4 degrees C) for three consecutive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees F (32.2 degrees C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provide water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete in Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

G. No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

3.6 INSTALLATION TOLERANCES

A. Surface Smoothness for Field Event Surfaces shall fall within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. 1/8 inch max in any direction, checked with a 10 foot straight edge

3.7 JOINTS

A. General: : Construct expansion, weakened -plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened Plane (Contraction) Joints: Provide weakened plane (contraction) joints, sectioning concrete into areas as shown on drawings or as indicated below. Construct weakened -plane joints for a depth equal to at least 1/4" wide x 1/4 of concrete thick-ness, as follows:

1. Tooled Joints: Form weakened plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Sawed Joints: Sawed joint WILL NOT BE ALLOWED.
3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

4. Unless indicated otherwise on the drawings. Weakened-plane joints shall be placed at maximum 5 ft. intervals each direction and located to conform to bay spacing wherever possible, or as shown on drawings.
- C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than ½ hour, except where such placements terminate at expansion joints.
1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
 2. Pinned Joints:
 - a. Expansion joints, joints between new and existing (old) concrete shall be suitably pinned together prevent vertical misalignment.
 - b. Joints between sidewalks and building or canopy slabs shall be suitably pinned together to prevent vertical misalignment.
 3. Provide preformed galvanized steel keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
 4. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 5. Provide tie bars at sides of paving strips where indicated.
 6. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Expansion Joints: Use ASTM D 1751, non-extruding premoulded joint filler, 3/4" thick, composed of fiberboard impregnated with asphalt, for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
- E. Expansion Joints: At ramps and walks, use ASTM D 1751, non-extruding premoulded material, ½" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt.
- F. Locate expansion joints at intervals not greater than 50' unless indicated otherwise.
- G. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
- H. Furnish joint fillers in one piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- I. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- J. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.8 FINISHING

A. Mechanical Finishing Machine Method:

1. The concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the elevations as shown on project drawings.
2. A depth of excess concrete shall be carried in front of the strike off screed for the full width of the slab, whenever the screed is being used to strike off the pavement.
3. The finishing machine shall be provided with a screed, which will consolidate the concrete by pressure.
4. The concrete shall be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine.
5. The edges of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb.
6. Hand finishing tools shall be kept available for use in case the finishing machine breaks down.

B. Hand Finishing Method:

1. The concrete shall be struck off and consolidated by a vibrating screed or other approved equipment to the elevations shown on the project drawings.
2. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off and not be allowed to idle in the concrete.
3. Internal mechanical vibration shall be used alongside all formed surfaces.
4. Vibration operation shall be completed prior to final hand finishing.

C. Floating, Straightening, and Edging:

1. After concrete has been struck off and consolidated, it shall be further smoothed by means of a wood or aluminum float at least five (5) feet wide with a handle long enough to reach the entire width of the slab being placed.
2. The float shall be operated so as to remove any excess water and laitance, as well as surface irregularities. After floating operation, the pavement surface should be within the specific tolerances.
3. While concrete is still plastic, the pavement surface shall be tested for smoothness with a ten (10) foot straight edge swung from handles three (3) feet longer than one half the width of the pavement.
4. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than five (5) foot intervals transversely. After each test, the straight edge shall be moved forward one half its length and the operation continued.
5. When irregularities are discovered, they shall be corrected by adding or removing concrete.
6. All disturbed areas shall be again floated with the wooded float and again straight edged.
7. The pavement shall have no depression in which water will stand.

8. Before final finishing is completed and before concrete has taken its initial set, the edges of the pavement shall be carefully finished with an edger of the radius shown on the project drawings.

D. Final Surface Finish:

1. A broom finish shall be used as the final finishing method. A hard bristle broom shall be used, which shall be kept clean and used in such a manner as to provide a uniform texture surface.
2. The final surface of the concrete pavement shall have a uniform gritty texture, free from excessive roughness and true to the grades and cross sections shown on the project drawings.
3. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

3.9 PROTECTING AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing immediately after finishing concrete as soon as marring of the concrete will not occur.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven (7) days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
 2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tap or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: after curing period had elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to pavement indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspection: Owner to engage a qualified testing and inspection agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement. Contact the Engineer a minimum of 24 hours prior to the placement of concrete for his approval and observation of the placement of all reinforcing.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength.

C. Concrete Tests: Testing of composite samples of fresh concrete shall be obtained according to ASTM C 172 and as follows:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five (5) compressive strength tests for each concrete mixture, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one hourly test when air temperature is 40 degrees F (4.4 degrees C) and below or when air temperature is 80 degrees F (26.7 degrees C) or above; and one test for each composite sample.
5. Compressive-Strength Testing: ASTM C 39/C 39M.
 - a. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

- b. A compressive-strength test result shall be the average compressive strength from a set of two specimens obtained from the same composite sample and tested at the age indicated.
6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test values falls below specified compressive strength by more than 500 psi.
7. Test results shall be reported, in writing, to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspection agency, location of concrete batch in work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, an type of break for both 7 and 28-day tests.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer, but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Engineer.
10. Additional testing and inspection, at Owner's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 321100

SECTION 321216 - ASPHALT PAVING - Alternate No. 3

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. Hot-mix asphalt paving.
 - 2. Pavement-marking paint.

- B. Related Sections:

- 1. Division 32 Sections "Concrete Paving" for cast-in-place concrete curbs and gutters serving as edge restraints.
 - 2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by engineer, of approval of each job mix proposed for the Work.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified manufacturer.
- B. Material Test Reports: For each paving material.
- C. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A paving-mix manufacturer registered with and approved by the State of Missouri or MoDOT.
- B. **Testing Agency Qualifications:** Qualified according to ASTM D 3666 for testing indicated.
- C. **Regulatory Requirements:** Comply with materials, workmanship, and other applicable requirements of the State of Missouri for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- D. **Preinstallation Conference:** Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. **Pavement-Marking Paint:** Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material or ASTM D 946 for penetration-graded material.
- C. Prime Coat: Asphalt emulsion prime coat complying with the State of Missouri or MoDOT requirements.
- D. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Water: Potable.
- F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - 1. Color: 4" white.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by the State of Missouri and designed according to MoDOT procedures.
 - 1. Provide mixes with a history of satisfactory performance in the State of Missouri.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: 6-inch deep, APWA Type 1-01.
 - b. Surface Course: 2-inch deep, APWA Type 3-01.

PART 3 - EXECUTION

3.1 SUBGRADE COMPACTION

- A. Compaction: Compact subgrade to 95% of materials maximum dry density per ASTM D698 at a moisture content of plus or minus 3%.

3.2 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.6 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.

3.7 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.

- b. Field density in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.9 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321216

SECTION 321313- CONCRETE PAVING

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. Curbs and gutters.
 - 2. Walks.
 - 3. Concrete Paving in Parking Lot
- B. Related Sections:
 - 1. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Fiber reinforcement.
- C. Other Action Submittals:
 - 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer.
- B. Field quality-control reports.

1.6 QUAL ASSU ANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Concrete Testing Service: Owner to engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- D. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.
 - e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

2.2 FIBER REINFORCEMENT

- A. Synthetic Fiber: Polypropylene fibers engineered and designed for use in concrete paving.

2.3 CONCRETE MATERIALS

- A. Provide cementitious material per Section 033000 - Cast-In-Place Concrete requirements.
- B. Water: Potable and complying with ASTM C 94/C 94M.
- C. Air-Entraining Admixture: ASTM C 260.

2.4 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Provide Membrane-Forming Curing Compound per Section 033000 - Cast-In-Place Concrete requirements.

2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with City of Springfield requirements.

2.6 DETECTABLE WARNING MATERIALS

- A. Detectable Warning Mat: Provide mechanically adhered 24-inch wide ADA mat.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Provide mixture as follows.
 - 1. Minimum Compressive Strength: 4500 PSI
 - 2. Maximum W/C Ratio: 0.45
 - 3. Slump Limit: 4 inches \pm 1 inch
 - 4. Air Content for Exterior Slabs: 6 percent \pm 1 percent the point of delivery for $\frac{3}{4}$ inch nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content to exceed 3 percent.
- C. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate.

2.8 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.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

2.9 SIDEWALKS

- A. Concrete shall be 6" thick concrete slab with broom finish perpendicular to traffic. Provide cross slope for positive drainage. Maximum cross slope shall be 2%. Tool all edges with $\frac{1}{4}$ " radius. Sidewalk shall be over 6" coarse aggregate base compacted to 95% standard proctor density. Compact top 6" of subgrade to 95% of maximum proctor density.
- B. Contraction Joint shall be tooled control joint with $\frac{1}{4}$ " radius each side. Space at 6'-0" on center maximum or as indicated on plan.
- C. Construction Joint shall receive #4 dowels at 18" on center. Grease dowel one end, to allow movement. In cases where a new slab joins an existing slab, drill the existing slab to receive dowels. Tool edge with $\frac{1}{4}$ " radius. Provide continuous caulk joint.

- D. Sidewalks to be 6'-0" wide unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Provide tie bars at sides of paving strips where indicated.
 - 2. Butt Joints: Use bonding agent or epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.
- H. Screed paving surface with a straightedge and strike off.

- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. 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.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing

operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete per Section 033000 - Cast-In-Place Concrete requirements.

3.8 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/2 inch.
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 6. Vertical Alignment of Dowels: 1/4 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 8. Joint Spacing: 3 inches.
 - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 10. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 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. Cold-applied joint sealants.
 - 2. Hot-applied joint sealants.
- B. Related Sections:
 - 1. Section 321216 "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 2. Section 321313 "Concrete Paving" for constructing joints in concrete pavement.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, Samples of materials that will contact or affect joint sealants.
 - 1. Use 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.
 - 2. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Pavement-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

- B. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- C. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Pecora Corporation; 300 SL.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Meadows, W. R., Inc.; Sealtight Hi-Spec or Sealtight 3405.
 - b. Right Pointe; D-3405 Hot Applied Sealant.
 - c. GEM SEAL; DURA-FILL 3405

2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions.

Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint 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.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement.
 - 1. Joint Location:
 - a. Expansion and isolation joints in cast-in-place concrete pavement.
 - b. Contraction joints in cast-in-place concrete slabs.
 - 2. Silicone Joint Sealant for Concrete: Single component, self-leveling.
 - 3. Hot-Applied Joint Sealant for Concrete: Single component.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt pavement.
 - b. Joints between concrete curbs and asphalt pavement.
 - 2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION 321373

SECTION 321723 - PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Provide labor, material, and equipment necessary installation of pavement markings as shown on the Project Drawings.
- B. Provide labor, material, and equipment necessary for the removal of existing pavement markings as shown to be removed on the Project Drawings.

1.2 SUBMITTALS

- A. Manufacturer's Certificates and Data certifying that the paint, thermoplastic, and/or glass beads conform to the requirements specified.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 – PRODUCTS

2.1 PAINT MATERIALS

- A. Pavement Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
- B. Colors:
 - 1. White Chip #37925
 - 2. Yellow Chip #33538
 - 3. Blenda Color Blue #A6011
- C. Glass Beads: AASHTO M 247, Type 1.

2.2 THERMOPLASTIC MATERIALS

- A. Thermoplastic materials shall conform to MoDOT Specification Section 620.

PART 3 – EXECUTION

3.1 PAINT INSTALLATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees F (4.4 degrees C) for oil-based materials; 55 degrees F (12.8 degrees C) for water based materials; and not exceeding 95 degrees F (35 degrees C) for either.
- C. Do not apply pavement marking paint until layout, colors, and placement have been verified with the Engineer.
- D. Sweep and clean surface to eliminate loose material and dust.
- E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
- F. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb./gal. (0.72 kg/L).

3.2 THERMOPLASTIC INSTALLATION

- A. Proceed with pavement marking only on clean, dry surfaces and at a minimum pavement surface temperature of 60 degrees F (15.6 degrees C) and a minimum ambient temperature of 50 degrees F (10 degrees C).
- B. A primer shall be applied to bituminous surfaces over 2 months old and all concrete surfaces. Primer is not required on new bituminous surfaces unless recommend by the thermoplastic manufacturer. Primer shall be applied and cured in accordance with the recommendations of the thermoplastic manufacturer.
- C. Temperature of the thermoplastic at the time of application shall be 400 – 425 degrees F (204.4 – 232.2 degrees C).
- D. Furnished markings shall have well defined edges and be free of waviness.

3.3 PROTECTION

- A. Conduct operations in such a manner that necessary traffic can move without hindrance.
- B. Protect newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint.

3.4 REMOVAL OF MARKINGS

- A. Preformed removable tape shall be removed by had methods.
- B. Paint shall be removed from Portland cement concrete pavement by a high pressure water blast method, or a low pressure water and sand blast method, or a steel shot blast method.
- C. Paint shall be removed from bituminous pavement by either a low pressure water and sand blast method or by a steel shot blast method.
- D. Paint shall be removed without damaging the surface or texture and without leaving an image which might mislead traffic.
- E. High pressure water blast methods shall not exceed 10,000 psi.
- F. Low pressure water and sand blast methods shall not exceed 3,000 psi.

END OF SECTION 321723

SECTION 321816 - RUBBERIZED SURFACING – ALTERNATE No. 2

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Unitary, seamless surfacing.

1.2 DEFINITIONS

- A. Critical Height: Standard measure of shock attenuation according to ASTM F 2223; same as "critical fall height" in ASTM F 1292.
- B. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F 2223.

1.3 SUBMITTALS

- A. Product Data: For each type of product including appropriate maintenance and care.
- B. Samples: For each color specified.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F 1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F 1951.

- C. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
1. Playbound Poured-in-Place by Surface America, Inc., DuraPlay Surfacing System by DuraPlay, Inc., SpectraPour by Spectra Turf, Inc., or approved equal.
 2. Critical Height: Varies per play structure, ranges between 40 inches and 96 inches.
 3. Overall Thickness: 4 inches.
 4. Primer: Manufacturer's standard single-component moisture cured urethane primer suitable for substrate and location.
 5. Binder: Manufacturer's standard weather-resistant, elastic polyurethane pre-polymer, MDI based, low odor binder suitable for unit, substrate, and location. Binder shall contain no TDI monomers.
 6. Wearing Layer Colors: As selected by Architect from manufacturer's full range.
 - a. 50% Green, 25% Black, and 25% Beige

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.
1. Repair: Fill holes and depressions in unsatisfactory surfaces with crushed aggregate.
 2. Terminal Edges: Form and pour adjacent concrete sidewalks for terminal edges of protective surfacing.

3.2 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
1. Primer: Apply over prepared substrate at a rate of 300 square feet per gallon. Prime the top of the continuous concrete stop around the perimeter and on all adjacent vertical barriers including, but not limited to, sidewalks, and any equipment or support legs that will contact the surfacing system. Do not apply primer to crushed aggregate.
 2. Poured Cushioning Layer: Spread evenly over primed substrate and crushed aggregate in one continuous operation with no cold joints. As the mixture is leveled, apply a downward pressure onto the surface so that the mixture compacts tightly. Check surface to be level. Allow to dry for 10 to 12 hours or until no indentations can be made by foot traffic.
 3. Binder: Over cured cushioning layer, apply binder at a nominal thickness of ½ inch.
 4. Wearing Layer: Spread over primed base course in one continuous operation. As the mixture is leveled, apply a downward pressure onto the surface so that the mixture compacts tightly. Cold joints must be cut and primed prior to installing a different color. Allow to cure for a minimum of 24 to 48 hours prior to usage. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
 5. Edge Treatment: Flush, as indicated on the Drawings.

END OF SECTION 321816

SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division Specification sections, and the Approved DNR Land Disturbance Permit, apply to the Work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. Furnish all materials, labor, equipment, and services necessary to perform all Work.
- B. Work included in this Section includes clearing of weeds, seed bed preparation, installation of erosion control fabric and seeding operations required for seeding of the areas shown on Drawings.

1.3 SPECIFICATIONS AND STANDARDS

- A. U.S. Department of Agriculture: SRA 156 U.S. Department of Agriculture, Rules, and Regulations under the Federal Seed Act.
- B. American Joint Committee on Horticultural Nomenclature Standard: 1942 Edition Standardized Plant Names.

PART 2 - PRODUCTS

2.1 SEED

- A. All seed shall be furnished in sealed, standard containers, unless otherwise approved. Seed which has become wet, moldy, or otherwise damaged will not be acceptable.
- B. Each container of seed shall be fully labeled in accordance with the Federal Seed Act and seed certifications shall be signed and made part of seed invoices.
- C. Seed shall be a mix consisting of 20% Bluegrass, 70% of 3 types of Turf Type Tall Fescue, and 10% Perennial Rye. All percentages refer to percent pure live seed.
- D. Invoices and tags for seed shall show type furnished. Upon acceptance of the seeded areas, a final check of total quantities of seed used will be made against total area seeded and if minimum rates of application or specified quantities have not been met, the Architect will require distribution of additional quantities of these materials to make up minimum application specified.

2.2 FERTILIZER

- A. Fertilizer shall be uniform in composition, free-flowing, suitable for application with approved equipment and delivered to the site unopened in original containers each bearing the manufacturer's guaranteed analysis and in conformity with state fertilizer laws. Fertilizer shall contain the following minimum percentage of plant food by weight.
 - 1. 12 percent available nitrogen
 - 2. 12 percent available phosphoric acid
 - 3. 12 percent available potash

- B. Fertilizer application rates shall be 600 pounds per acre with a minimum of 300 pounds applied.
- C. Invoices for fertilizer shall show grade furnished. Upon acceptance of the seeded areas, a final check of total quantities of fertilizer used will be made against total area seeded and if minimum rates of application or specified quantities have not been met, the Architect will require distribution of additional quantities of these materials to make up minimum application specified.

2.3 EROSION CONTROL FABRIC

- A. Fabric shall be “Soil Saver” distributed by Jim Walls Company in Dallas, Texas (214) 239-8577; “Curlex Blankets” distributed by American Excelsior Company in North Kansas City, Missouri (816) 842-3034; or “Single Net Excelsior Blanket” distributed by DeWitt in Sikeston, Missouri (573) 472-0048, or approved equal.

2.4 STAPLES

- A. Staples shall be a No. 11 gauge steel wire formed into a “U” shape, 6 inches long.

PART 3 - EXECUTION

3.1 GROUND PREPARATION

- A. General: the ground areas are to be seeded and fertilized as indicated on the Drawings and/or as specified herein. Equipment necessary for the proper preparation of the ground surface and for handling and placing all required materials shall be on hand, in good condition and shall be approved before the Work is started.
- B. Clearing: Prior to tillage, seeding or other specified operations, all vegetation which might interfere with the indicated treatment of the areas shall be mowed, grubbed, raked and the debris removed from the site. Prior to or during grading and tillage operations, the ground surface shall be cleared of materials which might hinder final operations. Areas which have been disturbed shall be finish graded and/or developed as indicated on the Drawings or as specified.
- C. Tillage: After the areas required to be seeded have been brought to the finish grades as specified, they shall be thoroughly tilled to a depth of at least 6 inches by plowing, disking, harrowing or other approved methods until the condition of the soil is acceptable to the Architect. Work shall be performed only during the period when beneficial results are likely to be obtained. When conditions are such by reason of drought, excessive moisture, or other factors that satisfactory results are not likely to be obtained, Work shall be stopped. Work shall be resumed only when desired results are likely to be obtained.
- D. Leveling: Any undulations or irregularities in the surface resulting from tillage, fertilizing or other operations shall be leveled with a float drag before seeding operations are begun.
- E. Fertilizing: Fertilizer shall be distributed uniformly at the rate previously specified per 1,000 square feet over the areas to be seeded and shall be incorporated into the soil to a depth of at least 3 to 4 inches by disking, harrowing or other approved methods. The incorporation of fertilizer may be a part of the tillage operation hereinbefore specified. Distribution by means of an approved seed drill equipped to sow seed and distribute fertilizer at the same time will not be accepted. Fertilizer shall be incorporated into the soil a minimum of 10 days before seed is planted.
- F. Inspection: A minimum of 48 hours prior notice must be given to the Construction Administrator before fertilizing may commence.

- G. Planting Time: All seeding Work shall be done between the dates of April 1 to May 15 for spring planting and from August 15 to October 15 for fall planting except as otherwise directed in writing by the Construction Administrator.
- H. Planting Condition: No planting shall be done until a permanent source of water is available at the site for use by the Owner.

3.2 SEEDING

- A. General: Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause shall be reworked to restore the ground condition previously specified. Seed shall be planted by drill seeding.
- B. Drill Seeding: Seed shall be uniformly drilled to an average depth of ½ inch and at the rate of 8 pounds per 1,000 square feet using equipment having drills not more than 6 ½ inches apart. Row markers shall be used with the drill seeder.
- C. Rolling: Immediately after seeding, except for slopes 3 horizontal to 1 vertical and greater, the entire area shall be firmed with a roller not exceeding 90 pounds for each foot of roller width. Do not roll areas seeded with seed drills equipped with rollers.
- D. Inspection: A minimum of 48 hours' prior notice must be given to the Construction Administrator before seeding may commence.

3.3 INSTALLATION OF EROSION CONTROL FABRIC

- A. Fabric shall be rolled out in place. Fabric shall be applied without stretching and shall lie smoothly but loosely on the soil surface. The Contractor shall refer to the Drawings for details of fabric fastening.
- B. Application of the erosion control fabric shall occur the same day that the seeding of an area has taken place.
- C. Fabric shall completely cover all areas which are shown on the Drawings to be protected from erosion. After fabric installation, the entire area shall be rolled with a smooth roller weighing between 200 to 250 pounds. After rolling, the fabric shall be in intimate contact with the soil surface at all points. Any clods, etc., which hold the fabric off the ground should be removed. The fabric shall be forced down into any depressions and held there with a staple.

3.4 MAINTENANCE

- A. General: The project areas shall be always kept clean and care shall be taken that use of the premises shall not be unduly hampered by Work herein specified. The intent of this Section is to ensure a healthy, well-established turf, and prevent soil erosion in compliance with the Land Disturbance Permit issued by the Missouri Department of Natural Resources.
- B. Responsibility: The Owner shall be responsible for maintenance of all seeded areas upon completion of seeding and general acceptance by the Construction Administrator.
- C. Damage: Damage to seeded areas during the project shall be repaired by the people responsible for causing such damage.

3.5 GENERAL ACCEPTANCE

- A. The Construction Administrator shall inspect the seeded areas upon completion of seeding. Seeded areas shall be considered acceptable if the specified quantities of fertilizer & seed have been properly applied.

3.6 GUARANTEE

- A. The Contractor is responsible for the proper application of the fertilizer and seed. Watering, weeding, re-seeding, and mowing will be the responsibility of the Owner after proper application of the seed.

END OF SECTION 329200

SECTION 331000 - WATER UTILITY DISTRIBUTION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: requirements and specifications necessary to install the water distribution system as shown on the project drawings.
- B. Testing and disinfection of the installed system is incidental to the work.
- C. Provide construction staking in accordance with generally accepted practice for layout of underground utilities.
- D. The work includes coordination with building plumbing contractors and building plumbing plans.
- E. Coordinate responsibilities for installation of meters, vaults, check valves, backflow preventers, taps, valves and appurtenances with the local jurisdiction.
- F. Fees related to water meter installation, whether tap, meter or other fees will be paid by the Contractor. Identify fees for installation of water services and provide written report to the Owner.
- G. Connections between the new construction and existing mains may be made by the Local Jurisdiction. Water service may be brought to the property line by the Local Jurisdiction. Contractor shall verify the extent to Local Jurisdiction work and coordinate the work with the work of the Local Jurisdiction.

1.2 GENERAL CONDITIONS

- A. Coordinate installation of the water distribution system with grading and paving operations.
- B. Provide water mains when grade is within 6 inches of final grade and prior to paving base installation.
- C. After completion and testing of the water distribution system, provide the Owner with the Contractor's Material and Test Certificates required by the National Fire Protection Association.

1.3 SUBMITTALS

- A. Product Data for the following:
 - 1. Pipe and Fittings
 - 2. Valves, Meters, other accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flanged faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.

- B. During Storage: Use precautions for valves according to the following:
 - 1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

- C. Handling: Use sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

- D. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

- F. Protect flanges, fittings, and specialties from moisture and dirt.

- G. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

PART 2 – PRODUCTS

2.1 PIPE

- A. Ductile Iron or PVC pipe for diameters four (4) inches and larger:
 - 1. Designate, manufacture, and test ductile iron pipe in accordance with ANSI A21.51, A21.4 and AWWA C-151. Conform outside diameters to A21.50, Class 150 Standards for each size pipe. Wall thickness for each pipe not less than that specified under A21.50 for thickness Class 50 in accordance with AWWA C-104.
 - 2. Use approved ductile iron pipe push-on joints conforming to AWWA C-111.
 - 3. PVC may be installed where permitted by local jurisdiction:
 - a. For domestic potable water service, meet ASTM D 2241 PVC SDR 21 Class 200.
 - b. For fire protection systems, meet AWWA C900, rubber gasket joints, DR14, Class 200.

- B. PVC pipe for diameters smaller than four (4) inches:
 - 1. Conforming to ASTM D 1785 PVC Schedule 80

2.2 WATER PIPE FITTINGS

- A. Ductile iron fittings meeting AWWA C-153, for water pipes four (4) inches or larger. Use mechanical joint fittings, complete with joint accessories, for the class and type of pipe with which they are used. Use cement-lined fittings with the inside and outside bituminous-coated. Mark fittings with class and weight.
- B. PVC fittings conforming to ASTM D 2467 for PVC plastic fittings, schedule 80.

2.3 VALVES AND BOXES

- A. For valves larger than 2 inches, use cast iron gate valves, AWWA C500 or C509, metal or resilient seated, made by a recognized valve manufacturer: Mueller, Iowa, M&H or approved equal. Use valves constructed of an interchangeable parts system, with parts readily available, and meet the following requirements:
 - 1. Iron body bronze-mounted
 - 2. Double disc, parallel seat "O" ring seal, or resilient seat seals
 - 3. 150 psi minimum working pressure
 - 4. Counterclockwise (left) opening
 - 5. 2-inch operating nut
 - 6. Non-rising stem
 - 7. Joints as required for connection to main
- B. For valves up to and including 2 inches, use Bronze Body, Bronze Trim, Rising Stem, Inside Screw, Single Wedge or Disc.
- C. Provide underground valves in standard cast iron valve boxes. Use boxes of the two-piece screw type, adjustable to suit the depth of bury and type of valve, with a minimum shaft diameter of 5 1/4 inches. Provide one operating wrench for each ten valves, or fraction thereof.

2.4 THRUST BLOCKING

- A. Use pipe restrained by concrete thrust blocking as shown on the project drawings, in the event of the following pipe conditions:
 - 1. A change in direction with the use of a tee or bend.
 - 2. Reduction in the size of the line by use of a reducer.
 - 3. Termination of line (dead end).

2.5 DETECTION TAPE

- A. Lay metallic detection tape where PVC pipe is installed atop the pipe in the trench no less than 18 inches and no more than 24 inches below finish grade.
- B. Meet pipe manufacturer's specifications.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Line and Grade: Lay and maintain pipe to the required lines and grades with fittings, valves, and hydrants at the required locations and with joints centered and spigots hung with valve and hydrant stems plumb.
2. Protecting Underground and Surface Structures: Provide, at the Contractor's expense, temporary support, adequate protection and maintenance of underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.
3. Sub-Surface Exploration: Whenever necessary to determine the location of existing pipes, valves, or other underground structure, examine available records and make explorations and excavations.

B. Laying Pipe

1. Trench excavation shall be done in conformance with Section 312000 Earth moving, Article 3.5 Excavations for Utility Trenches.
2. Before lowering pipe into trenches, install bedding material so that when pipe is in the ditch, it will have a bearing for its entire length. Carefully examine the pipe for defects and clean the inside.
3. After placing pipe into ditch, wipe free of dirt, sand and foreign material the bell, gasket, and spigot. Apply to the gasket and spigot a film of lubricant. Enter the plain ends of the pipe into the socket and force the pipe into the socket until it makes contact with the bottom of the socket.
4. At times when pipe laying is not in progress, plug the open ends of the pipe by approved means and so no trench water enters the pipe.
5. Cutting Pipe: Perform cutting of pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damage to the pipe, using approved mechanical cutters.
6. Direction of Laying: Unless otherwise directed, lay pipe with bell ends facing in the direction of laying. For lines on an appreciable slope, bells face upgrade.
7. Permissible Deflection: Whenever necessary to deflect pipe from a straight line either in the vertical or the horizontal plane to avoid obstruction, to plumb stems, or where long radius curves are permitted, use the degree of deflection recommended by the manufacturer of the pipe.

C. Bedding and Backfilling

1. Bedding and Backfilling operations and materials shall conform the project drawings and Section 312000 Earth Moving, Article 3.10 Utility Trench Backfill.

D. Mechanical Joints

1. Thoroughly bolt mechanical joints in accordance with the manufacturer's recommendations with Tee Head Bolts and bolts of high strength low-alloy steel having a minimum yield point strength of 40,000 pounds per square inch, and an ultimate tensile strength of 70,000 pounds per square inch. Use gaskets and bolts and nuts that conform to ANSI A21.11. Use glands of high strength cast iron.
2. Installation:
 - a. The successful operation of the mechanical joint specified requires that the spigot be centrally located in the bell and adequate anchorage be provided where abrupt changes in direction and dead ends occur.
 - b. Brush the surfaces with which the rubber gasket comes in contact thoroughly with a wire brush just prior to assembly to remove loose rust or foreign material and to provide clean surfaces brushed with soapy water just prior to slipping the gasket over the spigot end and into the bell. Brush soapy water over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.
 - c. Tighten joint bolts using approved wrenches to a tension recommended by the pipe manufacturer. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange around the socket. Partially tighten the bottom bolt first, then the top bolt, next the bolts at either side, and finally, the remaining bolts. Repeat this cycle until bolts are within the above ranges and torques. If effective sealing is not attained at the maximum torque indicated, disassemble and re-assemble the joint after thorough cleaning. Overstressing of bolts to compensate for poor installation is not permitted.

E. Setting Appurtenances

1. Valves and Fittings: Set and joint gate valves and pipe fittings to new pipe in the manner previously specified for cleaning, laying, and jointing pipe.
2. Valve Boxes: Support, maintain center and plumb over the wrench nut of the gate valve with box cover flush with the surface of the finished pavement.
3. Water Meters, Backflow Preventers, Double Detector Check Valves, Vaults, etc.: Field adjust vault locations to fit into assigned vault areas, set vaults plumb and level, drain vaults as needed, leave no standing water in vaults. Seal wall openings around pipes with flexible sealant and grout to allow for pipe movement and vault settlement. Provide traffic grade top slabs, accessways, and

appurtenances where vaults are located in vehicular areas. Provide clearance around valves and flanges to allow for disassembly of piping and equipment.

F. Anchorage of Bends, Tees, and Plugs

1. Limiting Pipe Diameter and Degree of Bend: Apply reaction or thrust blocking on pipelines at tees, plugs, caps, and at bends deflecting 11 degrees or more, or prevent movement by attaching suitable metal rods or straps.
2. Material for Reaction Blocking: Use reaction or thrust blocking of concrete. Place blocking between solid ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance as shown on the drawings. Place the blocking so that the pipe and fitting joints are accessible for repair.

3.2 TESTING AND DISINFECTION

A. Hydrostatic Tests

1. Pressure During Tests: After the pipe has been laid and partially backfilled, test newly laid pipe or any other valved section of it, unless otherwise directed. Subject to a minimum hydrostatic pressure of 200 psi or 50 psi above the inlet static pressure if the inlet pressure exceeds 150 psi.
2. Duration of Pressure Tests: At least 2 hours.
3. Procedure: Conform to NFPA 24 and AWWA C600. Slowly fill each section of pipe with water and measure the specified test pressure measured at the lowest point elevation by means of a pump connected to the pipe in a satisfactory manner. Provide the pump, pipe connection, gauges, and necessary apparatus. Apply the tests to each valved section in order to check the leakage through valves.
4. Expelling Air Before Test: Before applying the specified test pressure, expel air from the pipe. Make taps, if necessary, at points of highest elevation and afterward tightly plug.
5. Leakage Defined: Leakage is defined as the quantity of water to be supplied into the newly laid pipe or any valved section of it necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled.
6. Permissible Leakage: Provide suitable means for determining the quantity of water lost by leakage under normal operating pressure. No pipe installation will be accepted until or unless the leakage is less than two (2) quarts per hour per 100 gaskets or joints irrespective of pipe diameter.
7. Variation from Permissible Leakage: When any test of combined sections of pipe laid disclose leakage per mile of pipe greater than that specified, or if individual sections show leakages greater than the specified limit, locate and repair the

defective joint until the leakage is within the specified allowance at no cost to the Owner.

8. Time for Making Tests: Subject pipe to hydrostatic pressure, inspect, and test for leakage at any convenient time after partial completion of backfilling. Truck water as necessary to make the test when each section is ready.

B. Sterilization

1. Sterilize in accordance with AWWA C601. Sterilize by the application of clear water containing a minimum of 50 ppm of available chlorine. Keep the chlorine bearing water in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period, maintain the chlorine residual in units and at extremities of pipelines at a minimum concentration of 25 ppm.
2. Chlorinating Valves and Hydrants: Operate valves and other appurtenances while the pipeline is filled with the chlorinated agent.
3. Final Flushing and Test: Following chlorination, thoroughly flush treated water from the newly laid pipeline at its extremities until the replacement water throughout its length, upon test, meets the requirements of the Local Jurisdiction. Arrange for test samples.
4. Repetition of Procedures: If the initial treatment prove ineffective, repeat the chlorinating procedure until confirmed tests show that water sampled conforms to the requirements previously stated.

C. Alternate Testing and Sterilization

1. Alternate or additional testing and sterilization methods may be requested by the Local Jurisdiction. Deviations from these methods may be employed with permission of the Local Jurisdiction.

END OF SECTION 331000

SECTION 333100 - SEWER UTILITY SEWERAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: requirements and specifications necessary to install the sanitary sewer piping, valves, and other accessories, excluding manholes, as shown on the project drawings.
- B. Testing of the installed system is incidental to the work.
- C. Provide construction staking in accordance with generally accepted practice for layout of underground utilities.
- D. The work includes coordination with building plumbing contractors and building plumbing plans.
- E. Fees related to sewer service installation, whether tap, meter or other fees will be paid by the Contractor. Identify fees for installation of sewer services and provide written report to the Owner.
- F. Connections between the new construction and existing mains may be made by the Local Jurisdiction. Sewer service may be brought to the property line by the Local Jurisdiction. Contractor shall verify the extent to Local Jurisdiction work and coordinate the work with the work of the Local Jurisdiction.

1.2 RELATED SECTIONS

- A. Section 312000 Earth Moving.

1.3 GENERAL CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. 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. Notify property owner not less than two days in advance of proposed utility interruptions.

1.4 SUBMITTALS

- A. Product Data for the following:

1. Pipe and Fittings
 2. Valves and cleanouts.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flanged faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 “Piping Applications” Article for applications of pipe and fittings materials.

2.2 PIPE AND FITTINGS

- A. PVC Gravity Sewer Pipe and Fittings: As specified on project drawings and according to the following:

1. SDR 21 PVC Sewer Pipe and Fittings: ASTM D 3034, gasketed joints. Gaskets are to conform to ASTM F 477, elastomeric seals.
2. SDR 21 PVC Sewer Pipe and Fittings: ASTM D 3034. Solvent-cemented joints. Solvent Cements are to conform to ASTM D 2564 and ASTM D 2855.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for non-pressure joints.
 1. Sleeve material for cast-iron soil pipe: ASTM C 564, rubber.
 2. Sleeve material for plastic pipe: ASTM F 477, elastomeric seal.
 3. Sleeve material for dissimilar pipe: Compatible with pipe materials being joined.
 4. Bands: Stainless steel, at least one at each pipe insert.
- B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe for non-pressure joints.
 1. Material for cast-iron soil pipe: ASTM C 564, rubber.
 2. Material for plastic pipe: ASTM F 477, elastomeric seal.
 3. Sleeve material for dissimilar pipe: Compatible with pipe materials being joined.

2.4 POLYETHYLENE PLASTIC (PE) FILM, PIPE ENCASEMENT

- A. ASTM A 674 or AWWA C 105; PE film, tube, or sheet, 8-mil thickness.

2.5 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 1. Light Duty: In earth or grass foot-traffic areas.
 2. Medium Duty: In paved foot-traffic areas.
 3. Heavy Duty: In vehicle-traffic service areas.
 4. Extra-Heavy Duty: In roads.
 5. Sewer Piping Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.6 DETECTABLE WARNING TAPE

- A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum six (6) inches wide and four (4) mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored green for sewer systems.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on the project drawings.

3.2 EARTHWORK

- A. Excavation, trenching, bedding, and backfilling are specified in Section 312000 Earth Moving.
- B. Hand trim excavations to required elevations. Correct over excavation with bedding material.
- C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 IDENTIFICATION

- A. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.4 PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for piping and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: As indicated on the project drawings:
 - 1. NPS 4 and NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints. (4 inch pipe is allowed on gravity service laterals from building to main only. All gravity sewer mains must be a minimum of 6 inches in diameter).
 - 2. NPS 8 and NPS 10: PVC sewer pipe and fittings, or gaskets and gasketed joints.
 - 3. NPS 12 and NPS 15: PVC sewer pipe and fittings, or gaskets and gasketed joints.

3.5 SPECIAL PIPE AND COUPLING APPLICATIONS

- A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
 - 1. Use the following pipe couplings for non-pressure applications:
 - a. Sleeve type to join piping, of same size, or with small difference in OD.
 - b. Increase/reducer-pattern, sleeve type to join piping of different sizes.
 - c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force main joints. Include PE film, pipe encasement.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.6 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Project drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Molded Tees shall be used for all "tee" connections for new construction of gravity sewers. Inserta-Tees® (or approved equal) shall be used on all tap connections to existing gravity sewer pipes.
- E. Install ductile iron, force main piping according to AWWA C 600.
- F. Install PVC force main piping according to AWWA M 23.
- G. Location of Sewers with respect to Water Mains:
 1. Horizontal Separation: Whenever possible, any sanitary sewer shall be laid at least 10 feet, horizontally, from a water main. When local conditions prevent a separation of 10 feet, the Missouri Department of Natural Resources (MoDNR) may allow a sanitary sewer to be laid closer than 10 feet to a water main provided that the sanitary sewer is laid at least 18 inches below the bottom of the water main. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical or slip-on joint ductile iron pipe and should be pressure tested to assure watertightness before backfilling. Both of these alternatives must be specifically approved by MoDNR on a case-by-case basis.
 2. Vertical Separation: Whenever sanitary sewers must cross water mains, the sewer shall be laid at such an elevation that the bottom of the water main is no closer than 18 inches above the top of the sewer. The vertical separation shall be maintained for that portion of the sanitary sewer located within 10 feet,

horizontally, of any water main it crosses. The crossing shall be arranged so that the sewer joints will be equal distance and as far as possible from the water main joints.

3. Unusual Conditions: Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the sewer line to pass over a water main, the sewer line shall be laid with slip-on mechanical joint ductile iron pipe, and the sewer line shall extend on each side of the crossing a distance from the water main of at least 10 feet. In making such a crossing, a full length of ductile iron pipe must be centered over or under the water main to be crossed so that the joints will be equidistant from the water main and as remote therefore as possible. The water main must also be constructed of ductile iron pipe with slip-on or mechanical joints until the nominal distance from the sewer line to the water main is at least 10 feet. Where a water main must cross under a sewer, a vertical separation of 18 inches between the bottom of the sewer and the top of the water main shall be maintained, with adequate support, especially for the larger sized sewer lines, to prevent them from settling on and breaking the water main. The sewer shall be constructed of ductile iron pipe for a distance of 10 feet on either side of the crossing, or other suitable protection as approved by the MoDNR.

H. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

I. All gravity sewer lines shall be installed with minimum slopes according to the following table:

<u>Sewer Size</u>	<u>Minimum Slope (feet per 100 feet)</u>
6 in.	0.60
8 in.	0.40
9 in.	0.33
10 in.	0.28
12 in.	0.22
14 in.	0.17
15 in.	0.15
16 in.	0.14
18 in.	0.12
21 in.	0.10
24 in.	0.08
27 in.	0.067
30 in.	0.058
36 in.	0.046

3.7 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

- B. Ductile Iron Sewer Pipe with Ductile Iron Fittings: According to AWWA C 600. Install PE film, pipe encasement over ductile iron sewer pipe and ductile iron fittings according to ASTM A 674 or AWWA C 105.
- C. PVC Pressure Pipe and Fittings: Join and install according to AWWA M 23.
- D. PVC Sewer Pipe and Fittings: As follows:
 - 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 - 2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.
- E. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- F. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.
- G. Install with top surfaces of components, except piping, flush with finished surface.

3.8 REACTION ANCHORAGE AND BLOCKING

- A. All unplugged bell and spigot or all-bell tees, Y-branches and bends deflecting 11-1/4 degrees or more with are installed in piping subject to internal hydrostatic heads in excess of 15 feet in exposed, or 30 feet in buried applications, shall be provided with suitable reaction blocking, struts, anchors, clamps, joint harness, or other adequate means for preventing movement of the pipe cause by unbalanced internal liquid pressure.
- B. Trench Installation: Where in trench, the forgoing designated fittings shall be provided with concrete thrust blocking between the fitting and solid, undisturbed ground in each case, except where solid ground blocking support is not available. At the tops of slopes vertical angle bends shall be anchored by means of steel strap or rod anchors securely embedded in or attached to a mass of concrete of sufficient weight to resist the hydraulic thrust at the maximum pressures to which the pipe will be subjected. All concrete blocking and anchors shall be installed in such a manner that all joints between pipe and fittings are accessible for repair.
- C. The bearing area of concrete reaction blocking against the ground or trench bank shall be as shown by the plans or as directed be the Engineer in each case. In the even that adequate support against undisturbed ground cannot be obtained, metal harness anchorages consisting of steel rods or bolts across the joint and securely anchored to pipe and fittings or other adequate anchorage facilities approved by the Engineer shall be installed to provide the necessary support. Should the lack of a solid vertical excavation face be due to careless or otherwise improper trench excavation, the entire cost of

furnishing and installing metal harness anchorages in excess of the contract value of the concrete blocking replaced by such anchorages shall be borne by the Contractor.

- D. For other locations: Reaction blocking, struts, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the project drawings or as directed by the Engineer.
- E. Protection of metal surfaces: All steel clamps, rods, bolts and other metal accessories used in reaction anchorages or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be adequately protected from corrosion with not less than two coats of Koppers "Bitumastic No. 50", or approved equal, heavy coal tar coating material, applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structure shall be painted with two coats (in addition to a primer coat) of paint approved by the Engineer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Benjamin Moore; Corotech Enamels
 - b. Rust-Oleum; Protective Enamel
 - c. Eastwood; Rust Encapsulator Plus
- F. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.9 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow of sewer.
- B. Set cleanout frames and covers in earth, set with tops a minimum of one (1) inch above surrounding grade.
- C. Set cleanout frames and covers in pavement flush with pavement surface.

3.10 CLOSING ABANDONED SANITARY SEWER PIPE

- A. Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping has been closed. Use either procedure below:
 - 1. Close open ends of piping with at least eight (8) inch thick brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

3.11 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. Place plug in end of incomplete piping at end of day and when work stops.
 - 2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at the completion of the project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged pipe.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.

3.12 FIELD TESTING

A. General:

- 1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- 2. Leaks and loss in test pressure constitute defects that must be repaired.
- 3. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

B. Pressure Tests:

- 1. The Contractor shall furnish all pumps, piping, labor, and other materials and services necessary to bring the piping up to the specified test pressure.
- 2. All pipes shall be pressure tested. Pipes which will be pressurized under normal operating conditions shall conform to the requirements of the hydrostatic pressure test. All other piping shall meet the requirements of the air leakage test.
- 3. Pipe in the sections to be tested shall be backfilled or center loaded with thrust blocks installed and completely backfilled. Interior pipe supports and restraint systems shall be completely installed prior to testing.

C. Hydrostatic Pressure Test:

1. Test connections shall be made and the pipe filled with water. Unless otherwise specified, a pressure of not less than 1.25 times the normal operating pressure (for the lowest point on the pipe line) but not less than 100 psi or not more than the rated working pressure of the pipe shall be used for testing.
2. After air removal, water shall be pumped in to bring the pipe to the specified pressure. The hydrostatic test shall be of at least a 2-hour duration. Test pressure shall not vary by more than plus or minus five (5) psi for the duration of the test. After two hours, additional water shall be drawn from a container of known volume. The amount of water required to return the system to the specified pressure shall not exceed the amount determined by the following formula:

$$Q = SD(P)^{1/2}/133200 \quad (\text{Equation 1})$$

Where

Q = Total allowable leakage in gallons per hour.

S = Length of section tested, feet.

D = Nominal pipe diameter, inches.

P = Test pressure, psi.

3. The allowable leakage must not exceed the volumes specified below for each 1,000 feet of the particular diameter of pipe being tested (table has been calculated based on Equation 1):

Hydrostatic Testing Allowance per 1,000 ft of Pipeline – gph
(AWWA C 600)

Avg. Test Pressure (psi)	Nominal Pipe Diameter (in)										
	1.5	2	3	4	6	8	10	12	14	16	18
100	0.11	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35
125	0.13	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51
150	0.14	0.18	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66
175	0.15	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79
200	0.16	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91

4. All exposed pipe, fittings, valves, and joints shall be inspected and all evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by excavation where the pipe has been covered with backfill. Should the leakage test results exceed allowable leakage, the test pressure shall be maintained for an additional period of time as directed by the Engineer to facilitate location of leaks.
5. All pipe, fittings, valves, pipe joints, and other materials which are found to be defective when the pipe line is tested shall be removed from the line immediately and replaced with new and acceptable material by and at the expense of the Contractor. The pressure test shall be repeated after repairing leaks and other

defective work until the pipe line installation conforms to specified requirements and is accepted by the Engineer.

D. Air Leakage Test:

1. Contractor shall perform air tests for all pipe sizes.
2. Air leakage testing shall be performed on lines as specified and on the following lines:
 - a. Outfall line
 - b. Drain lines
 - c. Sanitary sewer lines
3. Furnish all facilities required including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over-pressurization, and all miscellaneous items required.
 - a. The pipe plug for introducing air in to the line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fitting to accept a pressure test gauge indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.
 - b. The pressure test gauge shall meet the following minimum specifications:
 - i. Size (diameter) 4-1/2 inches
 - ii. Pressure Range 0-15 psi
 - iii. Figure Intervals 1 psi increments
 - iv. Minor Subdivisions 0.05 psi
 - v. Pressure Tube Burdon Tube or diaphragm
Accuracy + 0.25% of maximum scale reading
 - vi. Dial White coated aluminum with black lettering, 270 degrees arc and mirror edge
 - vii. Pipe Connection Low male 1/2 inch NPT

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air test are performed.

4. Test each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trench.
5. Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this

time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than shown in the table below, the pipe shall be presumed to be free of defects.

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for
Q=0.0015

(ASTM F 1417, Table 1)

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 t
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:40	34:17	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the pressure air test.

- In areas where ground water is known to exist, install a one-half inch diameter capped pipe nipple approximately 10 inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops

rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

E. Deflection Tests:

1. Deflection tests shall be performed on all flexible sewer pipe by the Contractor using a mandrel pull. The mandrel shall have not less than seven (7) arms. The mandrel pull cannot be performed any sooner than 30 days after the reach being tested has been installed and final backfill has been placed.
2. A section of sewer line reach shall be deemed as failed when the mandrel cannot be moved through it with reasonable force. The tests shall be performed without mechanical pulling devices.
3. At the conclusion of the mandrel pull, the Contractor, at his expense, shall be required to remove and replace all pipe which fails the test.
4. The mandrel diameter shall be based on 95 percent of the actual inside pipe diameter.

F. Alignment Tests:

1. At the Owner's or Engineer's instruction the Contractor shall check the alignment of a sewer line using either a laser beam or lamping methods.

END OF SECTION 333100

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

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 gravity-flow, nonpressure storm drainage outside the building, with the following components:
 - 1. Cleanouts.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene-monomer rubber.
- C. FRP: Fiberglass-reinforced plastic.
- D. LLDPE: Linear low-density, polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.
- I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.
- J. TPE: Thermoplastic elastomer.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify engineer no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without engineer's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 - 2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
 - 3. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 - 4. Silt-tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - 5. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.
- B. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, Type S, with smooth waterway for coupling joints.
 - 1. Silt-tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - 2. Soiltight Couplings: AASHTO MP7, corrugated, matching pipe and fittings.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
- B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
 1. NPS 3: ABS, SDR 35, sewer pipe and fittings; gaskets; and gasketed joints.
 2. NPS 3: Corrugated PE drainage pipe and fittings.
 3. NPS 4 and NPS 6: ABS, SDR 35, sewer pipe and fittings; gaskets; and gasketed joints.
 4. NPS 4 and NPS 6: Corrugated PE drainage pipe and fittings.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 3. Install piping with 36-inch minimum cover.
 4. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

3.4 PIPE JOINT CONSTRUCTION

- A. Follow piping manufacturer's written instructions.

- B. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 3. Join hubless cast-iron soil piping according to CISPI C310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
 4. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 5. Join corrugated PE piping according to CPPA 100 and the following:
 - a. Use silttight couplings for Type 2, silttight joints.
 - b. Use soiltight couplings for Type 1, soiltight joints.
 6. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.
- C. Join dissimilar pipe materials with pressure-type couplings.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
1. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
- B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.6 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.7 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.
- E. Fasten grates to channel sections if indicated.

- F. Assemble channel sections with flanged or interlocking joints.
- G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.8 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

SECTION 334600 - SUBDRAINAGE

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. Perforated-wall pipe and fittings.
 - 2. Drainage conduits.
 - 3. Drainage panels.
 - 4. Geotextile filter fabrics.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Drainage conduits, including rated capacities.
 - 2. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated HDPE Pipe and Fittings:
 - 1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
 - 3. Couplings: Manufacturer's standard, band type.

2.2 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets,

seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of **36 inches** unless otherwise indicated.
 2. Lay perforated pipe with perforations down.
 3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping according to ASTM D 2321.

3.5 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
- B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CONNECTIONS

- A. Comply with requirements for piping specified in Division 33 Section "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

SECTION 334610 - SUBDRAINAGE FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building Perimeter, Retaining Wall, and Under-Slab Drainage Systems.

1.2 RELATED REQUIREMENTS

- A. Section 312316 - EXCAVATION FOR SPRAY GROUNDS: Excavating for subdrainage system piping and surrounding filter aggregate.
- B. Section 31 23 23 - Fill and Backfill: Backfilling over underdrain aggregate, up to subgrade elevation.

1.3 REFERENCE STANDARDS

- A. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2009.
- B. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.
- C. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.
- D. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings; 1993.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride Pipe: ASTM F 949; 4 inch diameter; with required fittings.
 - 1. Features:
 - a. Pipe Stiffness: 46 psi.

- b. Smooth interior.
 - c. Double wall design.
 - d. Positive gasketed jointing system.
- 2. Perforation Dimensions:
 - a. Slot Dimension (inches): 1.062L by 0.031W.
 - b. Centers: 0.42 inches.
 - c. Perforation Open Area: 1.90 square inches per linear foot.
- B. Use perforated pipe at subdrainage system; unperforated through sleeved walls and where not under pervious fill.

2.2 AGGREGATE

- A. Underdrain Aggregate Material: As specified in Section 31 23 23.

2.3 ACCESSORIES

- A. Pipe Couplings: Solid PVC.
- B. Filter Fabric:
 - 1. Manufacturers and products:
 - a. Contech C60NW.
 - b. Propex Geotex 601.
 - c. Mirafi 160N.
 - 2. Properties:
 - a. Tensile Strength (Grab), ASTM D 4632: 160 lbs.
 - b. Apparent Opening Size, ASTM D 4751: 70 US Standard Sieve.
 - c. Water Flow Rate, ASTM D 4491: 110 gpm/sq. ft.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with structural fill.
- B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place filter fabric on compacted impervious fill prior to installation of pipe. Allow adequate material to allow for required overlap over top of pipe.
- B. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- C. Install 4 inches of underdrain aggregate over fabric unless shown otherwise on the drawings.
- D. Place drainage pipe on underdrain aggregate.
- E. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- F. When pipe elevations are shown on the Drawings, the pipe shall uniformly slope between the given elevations. If Contractor believes additional change in direction fittings are required in order to achieve the slopes shown, then Contractor shall notify Engineer prior to installation.
- G. Place pipe with perforations facing down. Mechanically join pipe ends.
- H. Install pipe couplings and fittings.
- I. Install underdrain aggregate at sides and top of pipe. Provide underdrain aggregate top cover compacted thickness of 4 inches unless shown otherwise on the drawings.
- J. Place filter fabric over levelled top surface of underdrain aggregate cover prior to subsequent backfilling operations.

- K. Place underdrain aggregate in maximum 4 inch lifts, consolidating each lift.
- L. Refer to Section 312323 for compaction requirements. Do not displace or damage pipe when compacting.
- M. Place fill materials indicated on drawings over underdrain assembly and compact.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.5 PROTECTION

- A. Protect pipe, filter fabric, and aggregate cover from damage or displacement until backfilling operation begins.

END OF SPEC SECTION 334610

SECTION 334910 - WET PIT FOR SPRAY GROUNDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Precast wet pit for spray ground.

1.2 RELATED SECTIONS

- A. Section 31 23 23 - Fill and Backfill.

1.3 REFERENCES

- A. ASTM A 48 - Standard Specifications for Gray Iron Castings; 1994.
- B. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2000.
- C. ASTM C 361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe; 1999.
- D. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 1997.
- E. ASTM C 497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile; 1998.
- F. ASTM C 990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants; 2000.
- G. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2000.
- H. ASTM D 4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials; 1999.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Drawings and data covering precast concrete sections and castings.
- C. Data submitted for steel-reinforced plastic manhole steps shall include verification of the type and grade of steel used for reinforcement, typical chemical analysis of the steel, type and classification of the plastic, and reports of acceptance tests performed in accordance with ASTM C 478, Section 12.6, and C 497, Section 10.

- D. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.
- E. Shop Drawings: Indicate manhole locations and elevations and pipe sizes and elevations of penetrations.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Precast concrete sections shall not be delivered to the job until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum.
- B. Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cast-in-Place Concrete: Materials, handling, forms, finishing, curing, and other work as specified in Section 033000.
- B. Precast wet pit for spray ground: Precast structure with base and sections. Rectangular dimensions as shown on the drawings. Designed to resist hydrostatic uplift.
 - 1. Minimum Wall Thickness: 1/12 of inside diameter, plus 1 inch.
 - 2. Reinforcement: ASTM C 478.
- C. Nonshrinking Grout:
 - 1. Manufacturers:
 - a. Grace "Supreme".
 - b. L&M "Crystex".
 - c. Master Builders "Masterflow 713 Grout" or "Set Grout".
 - d. Five Star Products "Five Star Grout".

- D. Resilient Manhole/Pipe Connectors:
- E. Mastic Fill: Butyl rubber compatible with resilient connector material.
- F. Gaskets:
 - 1. Mastic:
 - a. Manufacturers:
 - 1) Hamilton-Kent "Kent-Seal No. 2".
 - 2) Sheller-Globe "Tac-Tite".
 - 3) K.T. Snyder "Ram-Nek".
 - b. Gaskets shall meet the requirements of ASTM C 990.
 - c. Cross-sectional area as recommended by manhole manufacturer.
 - 2. Rubber:
 - a. ASTM C 361, Section 6.9.1, except gasket shall be synthetic, with hardness of 40 plus or minus 5 when measured by ASTM D 2240, Type A durometer.
 - b. Natural rubber will not be acceptable.
- G. Castings: ASTM A 48, Class 35B or better.
 - 1. Manhole Ring and Cover:
 - a. Manufacturer:
 - 1) Deeter Foundry, Inc.: Model 1031 Manhole Ring and Solid Cover, Tel: (800) 234-7466; Fax: (402) 464-8533.
 - 2) Acceptable manufacturers:
 - (a) Neenah: www.GroupNEI.com
 - (b) US Foundry: www.USFoundry.com
 - b. Application: For wet pit.
 - c. Materials:
 - 1) Gray iron with minimum tensile strength of 35,000 psi (ASTM A-48-83, Class 35B for gray iron).

- 2) Rated heavy duty for highway and street traffic. Suitable of H-20 load requirements of 16,000 lbs.
- 3) Ring height of 7 inches.
- 4) Opening size of 24 inches.

H. Manhole Steps:

1. Manufacturers:
 - a. H. Bowen "BOWCO No. 93813".
 - b. M.A. Industries "PS2-PF".
 - c. Lane International: www.LaneInternational.com
2. Steel-reinforced plastic; 1/2 inch deformed steel bar, ASTM A 615, Grade 60 minimum, totally encapsulated in copolymer polypropylene, ASTM D 4101.

2.2 MANUFACTURER

- A. The first riser sections for use with cast-in-place bases shall be provided with horseshoe-shaped boxouts for connecting piping to be grouted in, or with circular openings with continuous, circular, resilient connectors cast into the riser wall. Boxouts for grouting, if used, shall have surfaces grooved or roughened to improve grout bond.
- B. Precast base sections shall be provided with circular openings, with continuous, circular, resilient connectors cast into the wall.
- C. Resilient connectors shall be installed in accordance with the manufacturer's recommendations, except that connectors shall be positioned so that sealing or resealing operations may be accomplished from inside the manhole.
- D. Precast sections may be provided with lifting notches on the inside faces of walls to facilitate handling. Lifting notches shall be not more than 3 inches deep; holes extending through the wall will not be acceptable.
- E. If precast concrete base sections are used, part of the concrete invert fill may be furnished with the precast unit; however, a rough surface shall be provided to improve bond with the final invert fill. At least the top 2 inches of the concrete invert fill shall be installed in the field.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units shall be rejected.

3.2 CONSTRUCTION

A. Tops:

- 1. At the option of the Contractor, standard manholes may be constructed with cast-in-place concrete tops or precast concrete (developed) tops.
- 2. If lifting notches are provided to facilitate handling, the lifting notches shall be filled with non-shrink grout as specified in Section 13 11 15.

B. Bases:

- 1. At the option of the Contractor, standard manholes may be constructed with cast-in-place concrete bases or precast concrete (developed) bases.
 - a. If cast-in-place concrete bases are used, concrete shall be placed on undisturbed earth, unless shown otherwise, in accordance with applicable requirements of the Section 13 11 15.
 - 1) When resilient connectors are used with cast-in-place bases, the concrete fill under the connecting pipe outside the manhole shall be deleted and shall be replaced with granular embedment material to undisturbed earth.
 - b. If precast concrete (developed) bases are used, the subgrade materials shall be excavated to undisturbed earth and to a uniform elevation which will permit at least 4 inches of granular embedment material, as specified in Section 31 23 23, to be installed and compacted. The surface of the granular material shall be carefully graded and the base section accurately set so that connecting pipes will be on proper line and grade. The elevation of the granular material shall be adjusted as required until proper grade and alignment of the base section has been attained.
 - 1) No wedging or blocking under precast concrete bases will be permitted.
- 2. In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of

the pipe it connects. Side branches shall be connected with a radius of curve as large as practicable. All inverts shall be troweled to a smooth, clean surface.

C. Riser and Cone Sections:

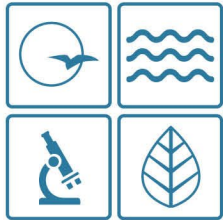
1. Circular precast sections shall be provided with a rubber or mastic gasket to seal joints between sections. Mastic gaskets shall be used only at temperatures recommended by the manufacturer. Lifting notches in manhole walls shall be filled with nonshrinking grout.
2. Manhole steps shall be plant-installed and shall be driven into prepared holes or vibrated into green concrete, in accordance with the recommendations of the step manufacturer.

D. Connecting Piping:

1. The space between connecting pipes and the wall of precast sections shall be completely filled with nonshrinking grout, except where resilient connectors are provided.
2. When resilient connectors are used, the connecting pipe shall be carefully adjusted to proper line and grade, and the bedding material shall be compacted under the haunches and to the spring line of the pipe for a distance of at least 6 feet from the manhole wall and to at least the minimum trench width. The pipe shall be installed in the resilient connector prior to backfilling outside the manhole and shall be resealed as required after completion of the manhole and backfill. All visible leakage shall be eliminated.
3. The connecting pipe for installation with resilient connectors shall be plain-end, square cut spigots and shall not protrude more than 1 inch inside the manhole wall. A clear distance of at least 1 inch from the end of each connecting pipe and around the pipe shall be provided when the concrete invert fill is installed. After completion of the manhole, the boxout shall be filled with mastic filler material, completely filling the space beneath the pipe and extending to at least the spring line. The filler material shall provide a smooth, uniform surface between the inside diameter of the pipe and the manhole invert.

END OF SPEC SECTION 334910

APPENDIX 1



MISSOURI DEPARTMENT OF NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin
Director

August 1, 2022

Leanne Mattern
Office of Administration, Facilities Management Design & Construction
Harry S. Truman SOB,
301 West High Street, Room 730
Jefferson City, MO 65102

Dear Permittee:

Pursuant to the Federal Water Pollution Control Act, under the authority granted to the State of Missouri and in compliance with the Missouri Clean Water Law, we have issued and are enclosing your Missouri State Operating Permit for Office of Administration, MOR-100038.

Please read and review your permit and attached Standard Conditions. They contain important information on site management and reporting requirements. Quarterly reports required by this report must be submitted through our eDMR system.

This permit may include requirements with which you may not be familiar. If you would like The Department of Natural Resources to meet with you to discuss how to satisfy the permit requirements, an appointment can be set up by contacting the permit writer at 573-526-1139. These visits are called Compliance Assistance Visits and focus on explaining the requirements to the permit holder.

This permit is both your Federal NPDES Permit and your new Missouri State Operating Permit and replaces all previous State Operating Permits issued for this facility under this permit number. In all future correspondence regarding this facility, please refer to your State Operating Permit number and facility name as shown on page one of the permit.

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to 10 CSR 20-1.020 and 10 CSR 20-6.020; RSMo Section 621.250, 640.013, and 644.051.6. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Contact information for the AHC is: Administrative Hearing Commission, Truman State Office Building, Room 640, 301 W. High Street, P.O. Box 1557, Jefferson City, Missouri 65102, phone: (573) 751-2422, fax: (573) 751-5018; website: <http://ahc.mo.gov/>.

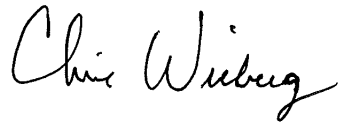


Office of Administration
Page Two

Please be aware that this facility may also be subject to any applicable county or other local ordinances or restrictions. If you have any questions concerning this permit, please do not hesitate to contact the Water Protection Program at P.O. Box 176, Jefferson City, MO 65102, 573-522-4502.

Sincerely,

WATER PROTECTION PROGRAM

A handwritten signature in black ink that reads "Chris Wieberg". The signature is written in a cursive style with a large initial "C" and a long, sweeping underline.

Chris Wieberg
Director

CW/qs

Enclosure

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION



MISSOURI STATE OPERATING PERMIT

General Operating Permit

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No MOR100038

Owner: OA-Facilities Mgmt, Design, and Construc
Address: 301 West High Street, Hst Rm 370
Jefferson City, MO 65101

Continuing Authority: OA Facilities Mgmt Design Construction
301 West High St.
HST SOB Rm 730
Jefferson City, MO 65102

Facility Name: Office of Administration
Facility Address: OA-FMDC, PO Box 809 301 W High street
JEFFERSON CITY, MO 65102

Legal Description: Land Grant 02681, Cole County
UTM Coordinates: 571840.000/4270368.000
Receiving Stream: Tributary to Wears Creek (U)
First Classified Stream - ID#: 100K Extent-Remaining Streams (C) 3960.00
USGS# and Sub Watershed#: 10300102 - 1304

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein.

FACILITY DESCRIPTION All Outfalls SIC #1629

All Outfalls - Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling and other activity that results in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution of waters of the state)

Issued to a city, county, state or federal agency, other governmental jurisdiction, or other private area-wide projects as determined by the Department on a case-by-case basis

This permit authorizes only wastewater, including storm water, discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System, it does not apply to other regulated areas. This permit may be appealed in accordance with RSMo Section 644.051.6 and 621.250, 10 CSR 20-6.020, and 10 CSR 20-1.020.

August 01, 2022

Issue Date

Chris Wieberg, Director
Water Protection Program

July 04, 2027

Expiration Date

I. APPLICABILITY

A. Permit Coverage and Authorized Discharges

1. This Missouri State Operating Permit (permit) authorizes the discharge of stormwater and certain non-stormwater discharges from land disturbance sites that disturb one or more acres, or disturb less than one acre when part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project.

A Missouri State Operating Permit must be issued before any site vegetation is removed or the site disturbed. Any site owner/operator subject to these requirements for stormwater discharges and who disturbs land prior to permit issuance from the Missouri Department of Natural Resources (Department) is in violation of both State regulations per 10 CSR 20-6.200(1)(A) and Federal regulations per 40 CFR 122.26. The owner/operator of this permit is responsible for compliance with this permit [10 CSR 20-6.200 (3)(B)].

2. This general permit is issued to a city, county, state or federal agency, other governmental jurisdiction, or other private area-wide projects as determined by the Department on a case-by-case basis, for land disturbance projects performed by or under contract to the permittee.
3. This permit authorizes stormwater discharges from land disturbance support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas, concrete, or asphalt batch plants) provided appropriate stormwater controls are designed, installed, and maintained and the following conditions are met and addressed in the Stormwater Pollution Prevention Plan (SWPPP). The permittee is responsible for compliance with this permit for any stormwater discharges from construction support activity.
 - (a) The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
 - (b) The support activity is not a commercial operation or serve multiple unrelated construction sites;
 - (c) The support activity does not continue to operate beyond the completion of the construction activity at the project it supports;
 - (d) Sediment and erosion controls are implemented in accordance with the conditions of this permit; and
 - (e) The support activity is strictly stormwater discharges or non-stormwater discharges listed in PART I, APPLICABILITY, Condition A.4. Support activities which discharge process water shall apply for separate coverage (e.g., a concrete batch plant discharging process water shall be covered under a MOG49).
4. This permit authorizes non-stormwater discharges associated with your construction activity from the following activities provided that these discharges are treated by appropriate Best Management Practices (BMPs) where applicable and addressed in the permittee's site specific SWPPP required by this general permit:
 - (a) Discharges from emergency fire-fighting activities;
 - (b) Hydrant flushing and water line flushing, provided the discharged water is managed to avoid instream water quality impacts;
 - (c) Landscape watering, including to establish vegetation;
 - (d) Water used to control dust;
 - (e) Waters used to rinse vehicles and equipment, provided there is no discharge of soaps, solvents, or detergents used for such purposes;
 - (f) External building washdown, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (e.g., paint or caulk containing polychlorinated biphenyls (PCBs))
 - (g) Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. Directing pavement wash waters directly into any water of the state, storm drain inlet, or stormwater conveyance (constructed or natural site drainage features), unless the conveyance is connected to an effective control, is prohibited;
 - (h) Uncontaminated air conditioning or compressor condensate;
 - (i) Uncontaminated, non-turbid discharges of ground water or spring water;
 - (j) Foundation or footing drains where flows are not contaminated with process materials; and
 - (k) Uncontaminated construction dewatering water discharged in accordance with requirements found in this permit for specific dewatering activities.

B. Permit Restrictions and Limitations

1. This permit does not authorize the discharge of process wastewaters, treated or otherwise.
2. For sites operating within the watershed of any Outstanding National Resource Water (which includes the Ozark National Riverways and the National Wild and Scenic Rivers System), sites that discharge to an Outstanding State Resource Water, or facilities located within the watershed of an impaired water as designated in the Clean Water Act (CWA) Section 303(d) list with an impairment for sedimentation/siltation:
 - (a) This permit authorizes stormwater discharge provided no degradation of water quality occurs due to discharges from the permitted facility per 10 CSR 20-7.031(3)(C).
 - (b) A site with a discharge found to be causing degradation or contributing to an impairment by discharging a pollutant of concern, during an inspection or through complaint investigations, may be required to become a no discharge facility or obtain a site-specific permit with more stringent monitoring and SWPPP requirements.
3. This permit does not allow placement of fill material into any stream or wetland, alteration of a stream channel, or obstruction of stream flow unless the appropriate CWA Section 404 permitting authority provides approval for such actions or determines such actions are exempt from Section 404 jurisdiction. Additionally, this permit does not authorize placement of fill in floodplains unless approved or determined exempt by appropriate federal and/or state floodplain development authorities.
4. This operating permit does not affect, remove, or replace any requirement of the National Environmental Policy Act; the Endangered Species Act; the National Historic Preservation Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; or any other relevant acts. Determination of applicability to the above mentioned acts is the responsibility of the permittee. Additionally, this permit does not establish terms and conditions for runoff resulting from silvicultural activities listed in Section 402(1)(3)(a) of the Clean Water Act.
5. Compliance with all requirements in this permit does not supersede any requirement for obtaining project approval from an established local authority nor remove liability for compliance with county and other local ordinances.
6. The Department may require any facility or site authorized by a general permit to apply for a site-specific permit [10 CSR 20-6.010(13)(C)].
7. If a facility or site covered under a current general permit desires to apply for a site-specific permit, the facility or site may do so by contacting the Department for application requirements and procedures.
8. Any discharges not expressly authorized in this permit and not clearly disclosed in the permit application cannot become authorized or shielded from liability under CWA section 402(k) or Section 644.051.16, RSMo, by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including any other permit applications, funding applications, the SWPPP, discharge monitoring reporting, or during an inspection. Discharges at the facility not expressly authorized by this permit must be covered by another permit, be exempt from permitting, or be authorized through some other method.

II. EXEMPTIONS FROM PERMIT REQUIREMENTS

1. Sites that discharge all stormwater runoff directly to a combined sewer system (as defined in 40 CFR 122.26 and 40 CFR 35.2005) connecting to a publicly owned treatment works which has consented to receive such a discharge are exempt from Department stormwater permit requirements.
2. Land disturbance activities that disturb less than one (1) acre of total land area which are not part of a common plan or sale where water quality standards are not exceeded are exempt from Department stormwater permit requirements.

3. Oil and gas related activities as listed in 40 CFR 122.26(a)(2)(ii) where water quality standards are not exceeded are exempt from Department stormwater permit requirements.
4. Linear, strip, or ribbon construction or maintenance operations meeting one (1) of the following criteria are exempt from Department stormwater permit requirements:
 - (a) Grading of existing dirt or gravel roads which does not increase the runoff coefficient and the addition of an impermeable surface over an existing dirt or gravel road;
 - (b) Cleaning or routine maintenance of roadside ditches, sewers, waterlines, pipelines, utility lines, or similar facilities;
 - (c) Trenches two (2) feet in width or less; or
 - (d) Emergency repair or replacement of existing facilities as long as BMPs are employed during the emergency repair.

III. REQUIREMENTS

1. The permittee shall post a public notification sign at the main entrance to the site, or a publically visible location, with the specific MOR100 permit number. The public notification sign must be visible from the public road that provides access to the site's main entrance. An alternate location is acceptable provided the public can see it and it is noted in the SWPPP. The public notification sign must remain posted at the site until the site is finalized.
2. The permittee shall be responsible for notifying the land owner and each contractor or entity (including utility crews and city employees or their agents) who will perform work at the site of the existence of the SWPPP and what actions or precautions shall be taken while on site to minimize the potential for erosion and the potential for damaging any BMP. The permittee is responsible for any damage a subcontractor may do to established BMPs and any subsequent water quality violation resulting from the damage.
3. Ensure the design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:
 - (a) Control stormwater volume, velocity, and peak flow rates to minimize soil erosion;
 - (b) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion and scour;
 - (c) Minimize the amount of exposed soil during construction activity;
 - (d) Minimize the disturbance of steep slopes;
 - (e) Minimize sediment discharges from the site. Address factors such as:
 - 1) The amount, frequency, intensity, and duration of precipitation;
 - 2) The nature of resulting stormwater runoff;
 - 3) Expected flow from impervious surfaces, slopes, and drainage features; and
 - 4) Soil characteristics, including the range of soil particle size expected to be present on the site.
 - (f) Provide and maintain natural buffers around surface waters as detailed in Part V. BMP REQUIREMENTS Condition 7, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration and filtering, unless infeasible; and
 - (g) Minimize soil compaction and preserve topsoil where practicable.

A 2-year, 24-hour storm event can be determined for the project location using the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 which can be located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html, or the permittee can determine local rainfall distribution for a 2-year, 24 hours storm event using multi-decade local high density rain gauge data, as approved by the Department.

4. BMPs for land disturbance [10 CSR 20-6.200(1)(D)2] are a schedule of activities, practices, or procedures that reduces the amount of soil available for transport or a device that reduces the amount of suspended solids in runoff before discharge to waters of the state. The term BMPs are also used to describe the sediment and erosion controls and other activities used to prevent stormwater pollution. BMPs are divided into two main categories: structural or non-structural; and they are also classified as temporary or permanent. Temporary BMPs may be added and removed as necessary with updates to the SWPPP as specified in the requirements below.

5. Installation of BMPs necessary to prevent soil erosion and sedimentation at the downgradient project boundary (e.g. buffers, perimeter controls, exit point controls, storm drain inlet protection) must be complete prior to the start of all phases of construction. By the time construction activity in any given portion of the site begins, downgradient BMPs must be installed and operational to control discharges from the initial site clearing, grading, excavating, and other earth-disturbing activities. Additional BMPs shall be installed as necessary throughout the life of the project.
6. All BMPs shall be maintained and remain in effective operating condition during the entire duration of the project, with repairs made within the timeframes specified elsewhere in this permit, until final stabilization has been achieved.
 - (a) Ensure BMPs are protected from activities that would reduce their effectiveness.
 - (b) Remove any sediment per the BMP manufacturer's instructions or before it has accumulated to one-half of the above-ground height of any BMP that collects sediment (i.e., silt fences, sediment traps, etc.)
 - (c) The project is considered to achieve final stabilization when Part V. BMP REQUIREMENTS, Condition 13 is met.
7. Minimize sediment trackout from the site and sediment transport onto roadways.
 - (a) Restrict vehicle traffic to designated exit points.
 - (b) Use appropriate stabilization techniques or BMPs at all points that exit onto paved roads or areas outside of the site.
 - (c) Use additional controls or BMPs to remove sediment from vehicle and equipment tires prior to exit from facility where necessary.
 - (d) Any sediment or debris that is tracked out past the exit pad or is deposited on a roadway after a precipitation event shall be removed by the shorter of either the same business day (for business days only), or by the end of the next business day if track-out occurs on a non-business day, and before predicted rain events. Remove the track-out sediment by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. Sediment or debris tracked out on pavement or other impervious surfaces shall not be disposed of into any stormwater conveyance, storm drain inlet, or water of the state.
 - (e) Stormwater inlets susceptible to receiving sediment or other pollutants from the permitted land disturbance site shall have curb inlet protection. This may include inlets off the active area where track out from vehicles and equipment could impact the stormwater runoff to those inlets.
8. Concrete washout facilities shall be used to contain concrete waste from the activities onsite, unless the washout of trucks and equipment is managed properly at an off-site location. The washout facility shall be managed to prevent solid and/or liquid waste from entering waters of the state by the following:
 - (a) Direct the wash water into leak-proof containers or pits designed so that no overflows can occur due to inadequate sizing or precipitation;
 - (b) Locate washout activities away from waters of the state, stormwater inlets, and/or stormwater conveyances where practicable. If not practicable, use BMPs to reduce risk of waste leaving the washout facility;
 - (c) Washout facilities shall be cleaned, or new facilities must be constructed and ready for use, once the washout is 75% full;
 - (d) Designate the washout area(s) and conduct such activities only in these areas.
 - (e) Ensure contractors are aware of the location, such as by marking the area(s) on the map or signage visible to the truck and/or equipment operators.
9. Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state.
 - (a) Provide solid and hazardous waste management practices, including providing trash containers, regular site cleanup for proper disposal of solid waste such as scrap building material, product/material shipping waste, food/beverage containers, spent structural BMPs;
 - (b) Provide containers and methods for proper disposal of waste paints, solvents, and cleaning compounds.
 - (c) Manage sanitary waste. Portable toilets shall be positioned so that they are secure and will not be tipped or knocked over and so that they are located away from waters of the state and stormwater inlets and stormwater conveyances.
 - (d) Ensure the storage of construction materials be kept away from drainage courses, stormwater conveyances, storm drain inlets, and low areas.

10. All fueling facilities present shall at all times adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers.
11. Any hazardous wastes that are generated onsite shall be managed, stored, and transported according to the provisions of the Missouri Hazardous Waste Laws and Regulations.
12. Store all paints, solvents, petroleum products, petroleum waste products, and storage containers (such as drums, cans, or cartons) so they are not exposed to stormwater or provide other prescribed BMPs (such as plastic lids and/or portable spill pans) to prevent the commingling of stormwater with container contents. Commingled water may not be discharged under this permit. Provide spill prevention, control, and countermeasures to contain the spill. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall prevent the contamination of groundwater.
13. Implement measures intended to prevent the spillage or loss of fluids, oil, grease, fuel, etc. from vehicles and equipment to thereby prevent the contamination of stormwater from these substances. This may include prevention measures such as, but not limited to, utilizing drip pans under vehicles and equipment stored outdoors, covering fueling areas, using dry clean-up methods, use of absorbents, and cleaning pavement surfaces to remove oil and grease.
14. Spills, Overflows, and Other Unauthorized Discharges.
 - (a) Any spill, overflow, or other discharge not specifically authorized in the permit above are unauthorized.
 - (b) Should an unauthorized discharge cause or permit any contaminants, other than sediment, or hazardous substance to discharge or enter waters of the state, the unauthorized discharge must be reported to the regional office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department's Environmental Emergency Response hotline at (573) 634-2436. Leaving a message on a Department staff member voice-mail does not satisfy this reporting requirement.
 - (c) A record of all spills shall be retained with the SWPPP and made available to the Department upon request.
 - (d) Other spills not reaching waters of the state must be cleaned up as soon as possible to prevent entrainment in stormwater but are not required to be reported to the Department.
15. The full implementation of this operating permit shall constitute compliance with all applicable federal and state statutes and regulations in accordance with RSMo 644.051.16 and the CWA §402(k); however, this permit may be reopened and modified or alternatively revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Clean Water Act §§ 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) if the effluent standard or limitation so issued or approved contains different conditions or is otherwise more stringent than any effluent limitation in the permit or controls any pollutant not limited in the permit. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, termination, notice of planned changes, or anticipated non-compliance does not stay any permit condition.

IV. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) MANAGEMENT REQUIREMENTS

1. The primary requirement of this permit is the development and implementation of a SWPPP which incorporates site specific practices to best minimize the soil exposure, soil erosion, and the discharge of pollutants, including solids for each site covered under this permit.

The purpose of the SWPPP is to ensure the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants in stormwater discharges associated with the land disturbance activities [40 CFR 122.44 (k)(4)] from entering waters of the state above established general and narrative criteria; compliance with Missouri Water Quality Standards; and compliance with the terms and conditions of this general permit.

- (a) **The SWPPP must be developed and implemented prior to conducting any land disturbance activities and must be specific to the land disturbance activities at the site.**
- (b) The permittee shall fully implement the provisions of the SWPPP required under this permit as a condition of this general permit throughout the term of the land disturbance project. Failure to develop, implement, and maintain a SWPPP may lead to immediate enforcement action.

- (c) The SWPPP shall be updated any time site conditions warrant adjustments to the project or BMPs.
 - (d) Either an electronic copy or a paper copy of the SWPPP, and any required reports, must be accessible to anyone on site at all times when land disturbance operations are in process or other operational activities that may affect the maintenance or integrity of the BMP structures and made available as specified under Part VIII. STANDARD PERMIT CONDITIONS, Condition 1 of this permit. The SWPPP shall be readily available upon request and should not be sent to the Department unless specifically requested
2. Failure to implement and maintain the BMPs chosen, which can be revised and updated, is a permit violation. The chosen BMPs will be the most reasonable and cost effective while also ensuring the highest quality water discharged attainable for the facility. Facilities with established SWPPPs and BMPs shall evaluate BMPs on a regular basis and change the BMPs as needed if there are BMP deficiencies.
 3. The SWPPP must:
 - (a) List and describe the location of all outfalls;
 - (b) List any allowable non-stormwater discharges occurring on site and where these discharges occur;
 - (c) Incorporate required practices identified below;
 - (d) Incorporate sediment and erosion control practices specific to site conditions;
 - (e) Discuss whether or not a 404 Permit is required for the project; and
 - (f) Name the person(s) responsible for inspection, operation, and maintenance of BMPs. The SWPPP shall list the names and describe the role of all owners/primary operators (such as general contractor, project manager) responsible for environmental or sediment and erosion control at the land disturbance site.
 4. The SWPPP briefly must describe the nature of the land disturbance activity, including:
 - (a) The function of the project (e.g., low density residential, shopping mall, highway, etc.);
 - (b) The intended sequence and timing of activities that disturb the soils at the site; and
 - (c) Estimates of the total area expected to be disturbed by excavation, grading, or other land disturbance support activities including off-site borrow and fill areas;
 5. In order to identify the site, the SWPPP shall include site information including size in acres. The SWPPP shall have sufficient information to be of practical use to contractors and site construction workers to guide the installation and maintenance of BMPs.
 6. The function of the SWPPP and the BMPs listed therein is to prevent or minimize pollution to waters of the state. A deficiency of a BMP means it was not effective in preventing or minimizing pollution of waters of the state.

The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs.

Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, (Document number EPA 833-R-06-004) published by the United States Environmental Protection Agency (USEPA) in May 2007. This manual as well as other information, including examples of construction SWPPPs, is available at the USEPA internet site at https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf; and <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp>.

The latest version of *Protecting Water Quality: A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri*, published by the Department. This manual is available at: <https://dnr.mo.gov/document-search/protecting-water-quality-field-guide>.

The permittee is not limited to the use of these guidance manuals. Other guidance publications may be used to select appropriate BMPs. However, all BMPs must be described and justified in the SWPPP. Although the use of these manuals or other resources is recommended and may be used for BMP selection, they do not supersede the conditions of this permit. They may be used to inform in the decision making process for BMP selection but they are not themselves part of the permit conditions.

The permittee may retain the SWPPP, inspection reports, and all other associated documents (including a copy of this permit) electronically pursuant to RSMo 432.255. The documents must be made available to all interested persons in either paper or electronic format as required by this permit and the permittee must remit a copy (electronic or otherwise) of the SWPPP and inspection reports to the Department upon request.

7. The SWPPP must contain a legible site map, multiple maps if necessary, identifying:
 - (a) Site boundaries of the property;
 - (b) Locations of all waters of the state (including wetlands) within the site and half a mile downstream of the site's outfalls;
 - (c) Location of all outfalls;
 - (d) Direction(s) of stormwater flow (use arrows) and approximate slopes before and after grading activities;
 - (e) Areas of soil disturbance and areas that will not be disturbed (or a statement that all areas of the site will be disturbed unless otherwise noted);
 - (f) Location of structural and non-structural BMPs, including natural buffer areas, identified in the SWPPP;
 - (g) Locations where stabilization practices are expected to occur;
 - (h) Locations of on-site and off-site material, waste, borrow, or equipment storage areas and stockpiles;
 - (i) Designated points where vehicles will exit the site;
 - (j) Location of stormwater inlets and conveyances including ditches, pipes, man-made conduits, and swales; and
 - (k) Areas where final stabilization has been achieved.
8. An individual shall be designated by the permittee as the environmental lead. This environmental lead shall have knowledge in erosion, sediment, and stormwater control principles, knowledge of the permit, and the site's SWPPP. The environmental lead shall ensure all personnel and contractors understand any requirements of this permit may be affected by the work they are doing. The environmental lead or designated inspector(s) knowledgeable in erosion, sediment, and stormwater control principles shall inspect all structures that function to prevent or minimize pollution of waters of the state.
9. Throughout coverage under this permit, the permittee shall amend and update the SWPPP as appropriate during the term of the land disturbance activity. All SWPPP modifications shall be signed and dated. The permittee shall amend the SWPPP to incorporate any significant site condition changes which impact the nature and condition of stormwater discharges. At a minimum, these changes include whenever the:
 - (a) Location, design, operation, or maintenance of BMPs is changed;
 - (b) Design of the construction project is changed that could significantly affect the quality of the stormwater discharges;
 - (c) The permittee's inspections indicate deficiencies in the SWPPP or any BMP;
 - (d) Department notifies the permittee in writing of deficiencies in the SWPPP;
 - (e) SWPPP is determined to be ineffective in minimizing or controlling erosion and sedimentation (e.g., there is visual evidence of excessive site erosion or sediment deposits in streams, lakes, or downstream waterways, sediment or other wastes off site); and/or
 - (f) Department determines violations of water quality standards may occur or have occurred.
10. Site Inspections: The environmental lead, or a designated inspector, shall conduct regularly scheduled inspections. These inspections shall be conducted by a qualified person, one who is responsible for environmental matters at the site, or a person trained by and directly supervised by the person responsible for environmental matters at the site. Site inspections shall include, at a minimum, the following:
 - (a) For disturbed areas that have not achieved final stabilization, all installed BMPs and other pollution control measures shall be inspected to ensure they are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
 - (b) For areas on site that have achieved either temporary or final stabilization, while at the same time active construction continues on other areas, ensure that all stabilization measures are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
 - (c) Inspect all material, waste, borrow, and equipment storage and maintenance areas that are covered by this permit. Inspect for conditions that could lead to spills, leaks, or other accumulations of pollutants on the site.
 - (d) Inspect all areas where stormwater typically flows within the site, including drainage ways designed to divert, convey, and/or treat stormwater.

- (e) All stormwater outfalls shall be inspected for evidence of erosion, sediment deposition, or impacts to the receiving stream. If a discharge is occurring during an inspection, the inspector must observe and document the visual quality of the discharge and take note of the characteristics of the stormwater discharge, including turbidity, color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants.
 - (f) When practicable the receiving stream shall also be inspected for a minimum of 50 feet downstream of the outfall.
 - (g) The perimeter of the site shall be inspected for evidence of BMP failure to ensure concentrated flow does not develop a new outfall.
 - (h) The SWPPP must explain how the environmental lead will be notified when stormwater runoff occurs.
11. Inspection Frequency: All BMPs must be inspected in accordance to one of the schedules listed below. The inspection frequency shall be documented in the SWPPP, and any changes to the frequency of inspections, including switching between the options listed below, must be documented on the inspection form:
- (a) At least once every seven (7) calendar days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday; or
 - (b) Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches of precipitation or greater, or the occurrence of runoff from snowmelt. To determine if a storm event of 0.25 inches or greater has occurred on the site, the permittee shall either keep a properly maintained rain gauge on site, or obtain the storm event information from a weather station near the site location.
 - 1) Inspections are only required during the project's normal working hours.
 - 2) An inspection must be conducted within 24 hours of a storm event which has produced 0.25 inches. The inspection shall be conducted within 24 hours of the event end, or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - 3) If it is elected to inspect every 14 calendar days and there is a storm event at the site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, the permittee shall conduct an inspection within 24 hours of the end of the storm or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - (c) Areas on site that have achieved stabilization, while at the same time active construction continues on other areas, may reduce inspection frequency to monthly, for those stabilized areas, if the following conditions exist:
 - 1) For areas where disturbed portions have undergone temporary stabilization, inspections shall occur at least once a month while stabilized and when re-disturbed shall follow either frequency outlined in (a),(b), or (c) above.
 - 2) Areas on site that have achieved final stabilization must be inspected at least once per month until the permit is terminated.
 - (d) If construction activities are suspended due to frozen conditions, the permittee may temporarily reduce site inspections to monthly until thawing conditions begin to occur if all of the following are met:
 - 1) Land disturbances have been suspended; and
 - 2) All disturbed areas of the site have been stabilized in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - 3) The change shall be noted in the SWPPP.
 - (e) Any basin dewatering shall be inspected daily when discharge is occurring. The discharge shall be observed and dewatering activities shall be ceased immediately if the receiving stream is being impacted. These inspections shall be noted on a log or on the inspection report.

If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (including pictures), and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The documentation must be filed with the regular inspection reports. The corrections shall be made as soon as weather conditions or other issues allow.

12. Site Inspection Reports: A log of each inspection and/or copy of the inspection report shall be kept readily accessible and must be made available upon request by the Department. Electronic logs are acceptable as long as reports can be provided within 24 hours. If inspection reports are kept off site, the SWPPP must indicate where they are stored. The inspection report shall be signed by the environmental lead or designated inspector (electronically or otherwise).
- (a) The inspection report is to include the following minimum information:
 - 1) Inspector's name and title.
 - 2) Date and time of inspection.
 - 3) Observations relative to the effectiveness of the BMPs and stabilization measures. The following must be

documented:

- a. Whether BMPs are installed, operational, and working as intended;
 - b. Whether any new or modified stormwater controls are needed;
 - c. Facilities examined for conditions that could lead to spill or leak;
 - d. Outfalls examined for visual signs of erosion or sedimentation at outfalls. Excessive erosion or sedimentation may be due to BMP failure or insufficiency. Response to observations should be addressed in the inspection report.
- 4) Corrective actions taken or necessary to correct the observed problem.
 - 5) Listing of areas where land disturbance operations have permanently or temporarily stopped.
13. Any structural or maintenance deficiencies for BMPs or stabilization measures shall be documented and corrected as soon as possible but no more than seven (7) calendar days after the inspection.
- (a) Corrective action documentation shall be stored with the associated site inspection report.
 - (b) Immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.
 - (c) If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (this may include pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The permittee shall correct the problem as soon as weather conditions or issues allow.
 - (d) Corrective actions may be required by the Department. The permittee must comply with any corrective actions required by the Department as a result of permit violations found during an inspection.

V. BMP REQUIREMENTS

1. The information, practices, and BMP requirements in this section shall be implemented on site and, where noted, provided for in the SWPPP.
2. Existing vegetation and trees shall be preserved where practicable. The permittee is encouraged to preserve topsoil where practicable.
3. The permittee shall select appropriate BMPs for use at the site and list them in the SWPPP. When selecting effective BMPs, the permittee shall consider stormwater volume and velocity. A BMP that has demonstrated ineffectiveness in preventing or minimizing sediment or other pollutants from leaving a given site shall be replaced with a more effective BMP, or additional and sequential BMPs and treatment devices may be incorporated as site conditions allow. The permittee should consider a schedule for performing erosion control measures when selecting BMPs.
4. The SWPPP shall include a description of both structural and non-structural BMPs that will be used at the site.
 - (a) The SWPPP shall provide the following general information for each BMP which will be used one or more times at the site:
 - 1) Physical description of the BMP;
 - 2) Site conditions that must be met for effective use of the BMP;
 - 3) BMP installation/construction procedures, including typical drawings; and
 - 4) Operation and maintenance procedures and schedules for the BMP.
 - (b) The SWPPP shall provide the following information for each specific instance where a BMP is to be installed:
 - 1) Whether the BMP is temporary or permanent;
 - 2) When the BMP will be installed in relation to each phase of the land disturbance procedures to complete the project; and
 - 3) Site conditions that must be met before removal of the BMP if the BMP is not a permanent BMP.
5. Structural BMP Installation: The permittee shall ensure all BMPs are properly installed and operational at the locations and relative times specified in the SWPPP.
 - (a) Perimeter control BMPs for runoff from disturbed areas shall be installed before general site clearing is started. Note this requirement does not apply to earth disturbances related to initial site clearing and establishing entry, exit, or access of the site, which may require that stormwater controls be installed immediately after the earth

disturbance.

- (b) For phased projects, BMPs shall be properly installed as necessary prior to construction activities.
 - (c) Stormwater discharges which leave the site from disturbed areas shall pass through an appropriate impediment to sediment movement such as a sedimentation basin, sediment traps (including vegetative buffers), or silt fences prior to leaving the land disturbance site.
 - (d) A drainage course change shall be clearly marked on a site map and described in the SWPPP.
 - (e) If vegetative stabilization measures are being implemented, stabilization efforts are considered “installed” when all activities necessary to seed or plant the area are completed. Vegetative stabilization is not considered “operational” until the vegetation is established.
6. Install sediment controls along any perimeter areas of the site that are downgradient from any exposed soil or other disturbed areas. Prevent stormwater from circumventing the edge of the perimeter control. For sites where perimeter controls are infeasible, other practices shall be implemented to minimize discharges to perimeter areas of the site.
7. For surface waters of the state, defined in Section 644.016.1(27) RSMo, located on or adjacent to the site, the permittee must maintain a riparian buffer or structural equivalent in accordance with at least one of the following options. The selection and location must be described in the SWPPP.
- (a) Provide and maintain a 50-foot undisturbed natural buffer; or
 - (b) Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
 - (c) If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
 - (d) The permittee is not required to comply with (a), (b), or (c) above if one or more of the following exceptions apply and documentation is provided in the SWPPP:
 - 1) As authorized per CWA Section 404 Department of the Army permit and its associated Section 401 Water Quality Certification from the Department.
 - 2) If there is no discharge of stormwater to waters of the state through the area between the disturbed portions of the site and waters of the state located within 50 feet of the site. This includes situations where the permittee has implemented permanent control measures that will prevent such discharges, such as a berm or other barrier.
 - 3) Where no natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for the current development of the site.
 - a. Where some natural buffer exists but portions of the area within 50 feet of the waters of the state are occupied by preexisting development disturbances the permittee is required to comply with (a), (b), or (c) above.
 - 4) For linear projects where site constraints make it infeasible to implement a buffer or equivalent provided the permittee limit disturbances within 50 feet of any waters of the state and/or the permittee provides supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the water of the state. The permittee must also document in the SWPPP the rationale for why it is infeasible for the permittee to implement (a), (b), or (c) and describe any buffer width retained and supplemental BMPs installed.
 - (e) Where the permittee is retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:
 - 1) The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or
 - 2) The edge of the stream or river bank, bluff, or cliff, whichever is applicable.
8. Slopes for disturbed areas must be identified in the SWPPP. A site map or maps defining the sloped areas for all phases of the project must be included in the SWPPP. The disturbance of steep slopes shall be minimized.
9. Manage stockpiles or land clearing debris piles composed, in whole or in part, of sediment and/or soil.
- (a) Locate the piles outside of any natural buffers zones, established under the condition above, and away from any stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated;
 - (b) Install a sediment barrier along all downgradient perimeter areas;
 - (c) Divert surface flows around stockpiles to reduce and minimize erosion of the stockpile.

- (d) For piles that will be unused for 14 or more days, provide cover with appropriate temporary stabilization in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - (e) Rinsing, sweeping, or otherwise placing any soil, sediment, debris, or stockpiled product which has accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the state is prohibited.
10. The site shall include BMPs for pollution prevention measures and shall be noted in the SWPPP. At minimum such measures must be designed, installed, implemented, and maintained to:
- (a) Minimize the discharge of pollutants from equipment and vehicle rinsing; no detergents, additives, or soaps of any kind shall be discharged. Rinse waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
 - (b) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater;
 - (c) Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures, including, but not limited to, the installation of containment berms and use of drip pans at petroleum product and liquid storage tanks and containers; and
 - (d) Prevent discharges from causing or contributing to an exceedance of water quality standards including general criteria.
11. Sedimentation Basins: The SWPPP shall include a sedimentation basin for each drainage area with ten or more acres disturbed at one time.
- (a) The sedimentation basin shall be sized, at a minimum, to treat a local 2-year, 24-hour storm.
 - (b) Sediment basins shall not be constructed in any waters of the state or natural buffer zones.
 - (c) Discharges from dewatering activities shall be managed by appropriate controls. The SWPPP shall include a description of any anticipated dewatering methods and specific BMPs designed to treat dewatering water.
 - 1) Appropriate controls include, but are not limited to, sediment socks, dewatering tanks, tube settlers, weir tanks, filtration systems (e.g. bag or sand filters), and passive treatment systems that are designed to remove or retain sediment.
 - 2) Erosion controls and velocity dissipation devices (e.g., check dams, riprap, and vegetated buffers) to minimize erosion at inlets, outlets, and discharge points from shall be utilized.
 - 3) Water with an oil sheen shall not be discharged and shall be marked in SWPPP.
 - 4) Visible floating solids and foam shall not be discharged.
 - (d) Until final stabilization has been achieved, sediment basins and impoundments shall utilize outlet structures or floating skimmers that withdraw water from the surface when discharging.
 - 1) Under frozen conditions, it may be considered infeasible to withdraw water from the surface and an exception can be made for that specific period as long as discharges that may contain sediment and other pollutants are managed by appropriate controls. If determined infeasible due to frozen conditions, documentation must be provided in the SWPPP to support the determination, including the specific conditions or time period when this exception applies.
 - (e) Accumulated sediment shall not exceed 50% of total volume or as prescribed in the design, whichever is less. Note in the SWPPP the locations for disposal of the material removed from sediment basins.
 - (f) Prevent discharges to the receiving stream causing excessive visual turbidity. For the purposes of this permit, visual turbidity refers to a sediment plume or other cloudiness in the water caused by sediment that can be identified by an observer.
 - (g) The SWPPP shall require the basin be maintained until final stabilization of the disturbed area served by the basin.

Where use of a sediment basin is infeasible, the SWPPP shall evaluate and specify other similarly effective BMPs to be employed to control erosion and sediment. These similarly effective BMPs shall be selected from appropriate BMP guidance documents authorized by this permit. The BMPs must provide equivalent water quality protection to achieve compliance with this permit. The SWPPP shall require both temporary and permanent sedimentation basins to have a stabilized spillway to minimize the potential for erosion of the spillway or basin embankment.

12. Soil disturbing activities on site that have ceased either temporarily or permanently shall initiate stabilization immediately in accordance with the options below. For soil disturbing activities that have been temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days:
 - (a) The permittee shall construct BMPs to establish interim stabilization; and
 - (b) Stabilization must be initiated immediately and completed within 14 calendar days.
 - (c) For soil disturbing activities that have been permanently ceased on any portion of the site, final stabilization of disturbed areas must be initiated immediately and completed within 14 calendar days.
 - 1) Allowances to the 14-day completion period for temporary and final stabilization may be made due to weather and equipment malfunctions. The use of allowances shall be documented in the SWPPP. Allowances may be determined unnecessary after review by the Department.
 - (d) Until stabilization is complete, interim sediment control shall consist of well-established and maintained BMPs that are reasonably certain to protect waters of the state from sediment pollution over an extended period of time. This may require adding more BMPs to an area than is normally used during daily operations. The types of BMPs used must be suited to the area disturbed, taking into account the number of acres exposed and the steepness of the slopes. If the slope of the area is greater than 3:1 (three feet horizontal to one foot vertical), then the permittee shall establish interim stabilization within seven days of ceasing operations on that part of the site. The following activities would constitute the immediate initiation of stabilization:
 - 1) Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable;
 - 2) Applying mulch or other non-vegetative product to the exposed areas;
 - 3) Seeding or planting the exposed areas;
 - 4) Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.
 - (e) If vegetative stabilization measures are being implemented, stabilization is considered “installed” when all activities necessary to seed or plant the area are completed. Installed does not mean established.
 - (f) If non-vegetative stabilization measures are being implemented, stabilization is considered “installed” when all such measures are implemented or applied.
 - 1) Non-vegetative stabilization shall prevent erosion and shall be chosen for site conditions, such as slope and flow of stormwater.
 - (g) Final stabilization is not considered achieved until vegetation has grown and established to meet the requirements below.
13. Prior to removal of BMPs, ceasing site inspections, and removing from the quarterly report, final stabilization must be achieved. Final stabilization shall be achieved as soon as possible once land disturbance activities have ceased. Document in the SWPPP the type of stabilization and the date final stabilization is achieved.
 - (a) The project is considered to have achieved final stabilization when perennial vegetation (excluding volunteer vegetation), pavement, buildings, or structures using permanent materials (e.g., riprap, gravel, etc.) cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetation must be at least 70% coverage of 100% of the vegetated areas on site. Vegetation must be evenly distributed.
 - (b) Disturbed areas on agricultural land are considered to have achieved final stabilization when they are restored to their preconstruction agricultural use. If former agricultural land is changing to non-agricultural use, this is no longer considered agricultural land and shall follow condition (a).
 - (c) If the intended function of a specific area of the site necessitates that it remain disturbed, final stabilization is considered achieved if all of the following are met:
 - 1) Only the minimum area needed remains disturbed (i.e., dirt access roads, motocross tracks, utility pole pads, areas being used for storage of vehicles, equipment, materials). Other areas must meet the criteria above.

- 2) Permanent structural BMPs (e.g., rock checks, berms, grading, etc.) or non-vegetative stabilization measures are implemented and designed to prevent sediment and other pollutants from entering waters of the state.
- 3) Inspection requirements in Part IV. SWPPP MANAGEMENT REQUIREMENT, Condition 11 are met and documented in the SWPPP.
- (d) Winter weather and frozen conditions do not excuse any of the above final stabilization requirements. If vegetation is required for stabilization the permittee must maintain BMPs throughout winter weather and frozen conditions until thawing and vegetation meets final stabilization criteria above. Document stabilization attempts during frozen conditions in the SWPPP. Consider future freezing when removing vegetation and plan with temporary stabilization techniques before the ground becomes frozen.

VI. SITE FINALIZATION & PERMIT TERMINATION

1. Until a site is finalized, the permittee must comply with all conditions in the permit, including continuation of site inspections and reporting quarterly to the Department. To finalize the site and remove from this permit coverage, the site shall meet the following requirements:
 - (a) For any areas that (1) were disturbed during construction, (2) are not covered over by permanent structures, and (3) over which the permittee had control during the construction activities, the requirements for final vegetative or non-vegetative stabilization in Part V. BMP REQUIREMENTS, Condition 13;
 - (b) The permittee has removed and properly disposed of all construction materials, waste, and waste handling devices and has removed all equipment and vehicles that were used during construction, unless intended for long-term beyond construction phase;
 - (c) The permittee has removed all temporary BMPs that were installed and maintained during construction, except those that are intended for long-term use or those that are biodegradable; and
 - (d) The permittee has removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following the construction activities.
2. The permit may be terminated if;
 - (a) There has been a transfer of control of all areas of the site for which the current permittee is responsible under this permit to another operator, and that operator has obtained coverage under this permit;
 - (b) Active sites obtain coverage under an individual or alternative general NPDES permit, with land disturbance conditions; or
 - (c) This permit may be terminated when all projects covered under this permit are finalized. In order to terminate the permit, the permittee shall notify the Department by submitting a Request for Termination along with the final quarterly report for the current calendar quarter.

VII. REPORTING AND SAMPLING REQUIREMENTS

1. The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns, or evidence of off-site impacts from activities at a site. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.
2. Electronic Discharge Monitoring Report (eDMR) Submission System. The NPDES Electronic Reporting Rule, 40 CFR Part 127, reporting of any report required by the permit shall be submitted via an electronic system to ensure timely, complete, accurate, and nationally consistent set of data for the NPDES program. The eDMR system is currently the only Department-approved reporting method for this permit unless specified elsewhere in this permit, or a waiver is granted by the Department. The facility must register in the Department's eDMR system through the Missouri Gateway for Environmental Management (MoGEM) before the first report is due.
3. Permittees shall prepare a quarterly report with a list of active land disturbance sites including any off-site borrow or depositional areas associated with the construction project and submit the following information electronically as an

attachment to the eDMR system until such a time when the current or a new system is available to allow direct input of the data:

- (a) The name of the project;
- (b) The location of the project (including the county);
- (c) The name of the primary receiving water(s) for each project;
- (d) A description of the project;
- (e) The number of acres disturbed;
- (f) The percent of completion of the project; and
- (g) The projected date of completion.

The quarterly report(s) shall be maintained by the permittee and readily available for review by the Department at the address provided on the application as well as submitted quarterly via the Department’s eDMR system. The permittee shall submit quarterly reports according to Table A.

Table A	Schedule for Quarterly Reporting
Activity for the months of:	Report is due:
January, February, March (1st Quarter)	April 28
April, May, June (2nd Quarter)	July 28
July, August, September (3rd Quarter)	October 28
October, November, December (4th Quarter)	January 28

VIII. STANDARD PERMIT CONDITIONS

1. Records: The permittee shall retain copies of this general permit, the SWPPP and all amendments for the site named in the State Operating Permit, results of any monitoring and analysis, and all site inspection records required by this general permit.
 - (a) The records shall be accessible during normal business hours and retained for a period of at least three (3) years from the date of termination.
 - (b) The permittee shall provide a copy (electronic or otherwise) of the SWPPP to the Department, USEPA, or any local agency or government representative if they request a copy in the performance of their official duties within 24 hours of the request (or next working day), unless given more time by the representative.
 - (c) The permittee shall provide a copy of the SWPPP to those who are responsible for installation, operation, or maintenance of any BMP. The permittee, their representative, and/or the contractor(s) responsible for installation, operation and maintenance of the BMPs shall have a current copy of the SWPPP with them when on the project site.

2. Land Ownership and Change of Ownership: Federal and Missouri stormwater regulations [10 CSR 20-6.200(1) (B)] require a stormwater permit and erosion control measures for all land disturbances of one or more acres. These regulations also require a permit for less than one acre lots if the lot is part of a larger common plan of development or sale where that plan is at least one acre in size.
 - (a) If the permittee sells any portion of a permitted site to a developer for commercial, industrial, or residential use, this land remains a part of the common sale and the new owner must obtain a permit prior to conducting any land disturbance activity. Therefore, the original permittee must amend the SWPPP to show that the property has been sold and, therefore, no longer under the original permit coverage.
 - (b) Property of any size which is part of a larger common plan of development where the property has achieved final stabilization and the original permit terminated will require application of a new land disturbance permit for any future land disturbance activity unless the activity is by an individual residential building lot owner on a site less than one acre.
 - (c) If a portion of a larger common plan of development is sold to an individual for the purpose of building his or her own private residence, a permit is required if the portion of land sold is equal to or greater than one acre. No permit is required, however, for less than one acre of land sold.

3. Permit Transfer: This permit may not be transferred to a new owner.

4. Termination: This permit may be terminated when the project has achieved final stabilization, defined in Part VI. **SITE FINALIZATION & PERMIT TERMINATION.**
 - (a) In order to terminate the permit, the permittee shall notify the Department by submitting the form Request for Termination of Operating Permit Form MO 780-2814. The form should be submitted to the appropriate regional office or through an approved electronic system if it should become available.
 - (b) The Cover Page (Certificate Page) of the Master General Permit for Land Disturbance specifies the “effective date” and the “expiration date” of the Master General Permit. The “issued date” along with the “expiration date” will appear on the State Operating Permit issued to the applicant. **This permit does not continue administratively beyond the expiration date.**
5. Duty to Reapply: If the project or development completion date will be after the expiration date of this general permit, then the permittee must reapply to the Department for a new permit. This permit may be applied for and issued electronically in accordance with Section 644.051.10, RSMo.
 - (a) Due to the nature of the electronic permitting system, a period of time may be granted at the discretion of the Department in order to apply for a new permit after the new version is effective. Applicants must maintain appropriate best management practices and inspections during the discretionary period.
6. Duty to Comply: The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Missouri Clean Water Law and Federal Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.
7. Modification, Revocation, and Reopening:
 - (a) If at any time the Department determines that the quality of waters of the state may be better protected by reopening this permit, or revoking this permit and requiring the owner/operator of the permitted site to apply for a site-specific permit, the Department may revoke a general permit and require any person to obtain such an operating permit as authorized by 10 CSR20-6.010(13) and 10 CSR 20-6.200(1)(B).
 - (b) If this permit is reopened, modified, or revoked pursuant to this Section, the permittee retains all rights under Chapter 536 and 644 Revised Statutes of Missouri upon the Department’s reissuance of the permit as well as all other forms of administrative, judicial, and equitable relief available under law.
8. Other Information: Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.
9. Duty to Provide Information: The permittee shall furnish to the Department, within 24 hours unless explicitly granted more time in writing, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.
10. Inspection and Entry: The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:
 - (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of the permit;
 - (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 - (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
 - (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Federal Clean Water Act or Missouri Clean Water Law, any substances or parameters at any location.

11. Signatory Requirement:
 - (a) All permit applications, reports required by the permit, or information requested by the Department shall be signed and certified. (See 40 CFR 122.22 and 10 CSR 20-6.010)
 - (b) The Federal Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit (including monitoring reports or reports of compliance or non-compliance) shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six (6) months per violation, or by both.
 - (c) The Missouri Clean Water Law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for not more than six months, or by both.
12. Property Rights: This permit does not convey any property rights of any sort or any exclusive privilege.
13. Notice of Right to Appeal: If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: <https://ahc.mo.gov>



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

STORMWATER DISCHARGES FROM
THIS LAND DISTURBANCE SITE ARE
AUTHORIZED BY THE MISSOURI
STATE OPERATING PERMIT NUMBER:

ANYONE WITH QUESTIONS OR
CONCERNS ABOUT STORMWATER
DISCHARGES FROM THIS SITE,
PLEASE CONTACT THE MISSOURI
DEPARTMENT OF NATURAL
RESOURCES AT

1-800-361-4827

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET FOR MASTER GENERAL PERMIT
MO-R100xxx

The Federal Water Pollution Control Act [Clean Water Act (CWA)] Section 402 of Public Law 92-500 (as amended) established the National Pollution Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the CWA). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (MSOPs) are issued by the Missouri Department of Natural Resources (Department) under an approved program operated in accordance with federal and state laws (Federal CWA and Missouri Clean Water Law Section 644 as amended). Permits are issued for a period of five (5) years unless otherwise specified.

Per 40 CFR 124.56, 40 CFR 124.8, and 10 CSR 20-6.020(1)(A)2, a Fact Sheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the permit. A Fact Sheet is not an enforceable part of an MSOP.

DEFINITIONS FOR THE PURPOSES OF THIS PERMIT:

Common Promotional Plan: A plan undertaken by one (1) or more persons to offer lots for sale or lease; where land is offered for sale by a person or group of persons acting in concert, and the land is contiguous or is known, designated, or advertised as a common unit or by a common name or similar names, the land is presumed, without regard to the number of lots covered by each individual offering, as being offered for sale or lease as part of a common promotional plan.

Dewatering: The act of draining rainwater and/or groundwater from basins, building foundations, vaults, and trenches.

Effective Operating Condition: For the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Emergency-Related Project: A project initiated in response to a public emergency (e.g. earthquakes, extreme flooding conditions, tornado, disruptions in essential public services, pandemic) for which the related work requires immediate authorization to avoid imminent endangerment to human health/safety or the environment or to reestablish essential public services.

Exposed Soils: For the purposes of this permit, soils that as a result of earth-disturbing activities are left open to the elements.

Immediately: For the purposes of this permit, immediately should be defined as within 24 hours.

Impervious Surface: For the purpose of this permit, any land surface with a low or no capacity for soil infiltration including, but not limited to, pavement, sidewalks, parking areas and driveways, packed gravel or soil, or rooftops.

Infeasible: Infeasible means not technologically possible or not economically practicable and achievable in light of best industry practices.

Install or Installation: When used in connection with stormwater controls, to connect or set in position stormwater controls to make them operational.

Land Disturbance Site or Site: The land or water area where land disturbance activities will occur and where stormwater controls will be installed and maintained. The land disturbance site includes construction support activities, which may be located at a different part of the property from where the primary land disturbance activity will take place or on a different piece of property altogether. Off-site borrow areas directly and exclusively related to the land disturbance activity are part of the site and must be permitted.

Larger Common Plan of Development or Sale: A continuous area where multiple separate and distinct construction activities are occurring under one plan, including any off-site borrow areas that are directly and exclusively related to the land disturbance activity. Off-site borrow areas utilized for multiple different land disturbance projects are considered their own entity and are not part of the larger common plan of development or sale. See definition of Common Promotional Plan to understand what a ‘common plan’ is.

Minimize: To reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

Non-structural Best Management Practices (BMPs): Institutional, educational, or pollution prevention practices designed to limit the amount of stormwater runoff or pollutants that are generated in the landscape. Examples of non-structural BMPs include picking up trash and debris, sweeping up nearby sidewalks and streets, maintaining equipment, and training site staff on stormwater control practices.

Operational: for the purposes of this permit, stormwater controls are made “operational” when they have been installed and implemented, are functioning as designed, and are properly maintained.

Ordinary High Water Mark: The line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris.

Peripheral: For the purposes of this permit, peripheral should be defined as the outermost boundary of the area that will be disturbed.

Permanently: For the purposes of this permit, permanently is defined as any activity that has been ceased without any intentions of future disturbance.

Pollution Prevention Controls (or Measures): Stormwater controls designed to reduce or eliminate the addition of pollutants to construction site discharges through analysis of pollutant sources, implementation of proper handling/disposal practices, employee education, and other actions.

Qualified Person (inspections): A person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Stormwater Control (also referred to as sediment/erosion controls): refers to any temporary or permanent BMP or other method used to prevent or reduce the discharge of pollutants to waters of the state.

Structural BMP: Physical sediment/erosion controls working individually or as a group (treatment train) appropriate to the source, location, and area climate for the pollutant to be controlled. Examples of structural BMPs include silt fences, sedimentation ponds, erosion control blankets, and seeding.

Temporary Stabilization: A condition where exposed soils or disturbed areas are provided temporary vegetation and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb this area.

Treatment Train: A multi-BMP approach to managing the stormwater volume and velocity and often includes erosion prevention and sediment control practices often applied when the use of a single BMP is inadequate in preventing the erosion and transport of sediment. A good option to utilize as a corrective action.

Volunteer Vegetation: A volunteer plant is a plant that grows on its own, rather than being deliberately planted for stabilization purposes. Volunteers often grow from seeds that float in on the wind, are dropped by birds, or are inadvertently mixed into soils. Commonly, volunteer vegetation is referred to as 'weeds'. This does not meet the requirements for final stabilization.

Waters of the State: Section 644.016.1(27) RSMo. defines waters of the state as, "All waters within the jurisdiction of this state, including all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common."

PART I – BASIC PERMIT INFORMATION

Facility Type: Industrial Stormwater; Land Disturbance
Facility SIC Code(s): 1629
Facility Description: Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling, and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit establishes a Stormwater Pollution Prevention Plan (SWPPP) requirement for pollutants of concern from this type of facility or for all facilities and sites covered under this permit. 10 CSR 20-6.200(7) specifies "general permits shall contain BMP requirements and/or monitoring and reporting requirements to keep the stormwater from becoming contaminated".

Land disturbance activities include clearing, grubbing, excavating, grading, filling and other activities that result in the destruction of the root zone and/or other activities that are reasonably certain to cause pollution to waters of the state. A Missouri State Operating Permit for land disturbance permit is required for construction disturbance activities of one or more acres or for construction activities that disturb less than one acre when they are part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project.

The primary requirement of a land disturbance permit is the development of a SWPPP which incorporates site-specific BMPs to minimize soil exposure, soil erosion, and the discharge of pollutants. The SWPPP ensures the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants from leaving the site.

When it precipitates, stormwater washes over the loose soil on a construction site and various other materials and products being stored outside. As stormwater flows over the site, it can pick up pollutants like sediment, debris, and chemicals from the loose soil and transport them to nearby storm sewer systems or directly into rivers, lakes, or coastal waters.

The Missouri Department of Natural Resources is responsible for ensuring that construction site operators have the proper stormwater controls in place so that construction can proceed in a way that protects your community's clean water and the surrounding environment. One way the department helps protect water quality is by issuing land disturbance permits.

Local conditions are not considered when developing conditions for a general permit. A facility may apply for a site-specific permit if they desire a review of site-specific conditions.

PART II – RECEIVING STREAM INFORMATION

APPLICABLE DESIGNATIONS OF WATERS OF THE STATE:

Per Missouri Effluent Regulations (10 CSR 20-7.015), the waters of the state are divided into seven (7) categories. This permit applies to facilities discharging to the following water body categories:

- ✓ Missouri or Mississippi River [10 CSR 20-7.015(2)]
- ✓ Lakes or Reservoirs [10 CSR 20-7.015(3)]
- ✓ Losing Streams [10 CSR 20-7.015(4)]
- ✓ Metropolitan No-Discharge Streams [10 CSR 20-7.015(5)]
- ✓ Special Streams [10 CSR 20-7.015(6)]
- ✓ Subsurface Waters [10 CSR 20-7.015(7)]
- ✓ All Other Waters [10 CSR 20-7.015(8)]

Missouri Water Quality Standards (10 CSR 20-7.031) defines the Clean Water Commission water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and/or 1st classified receiving stream's designated water uses shall be maintained in accordance with 10 CSR 20-7.031(24). A general permit does not take into consideration site-specific conditions.

MIXING CONSIDERATIONS:

This permit applies to receiving streams of varying low flow conditions. Therefore, the effluent limitations must be based on the smallest low flow streams considered, which includes waters without designated uses. As such, no mixing is allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)]. No Zone of Initial Dilution is allowed. [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

RECEIVING STREAM MONITORING REQUIREMENTS:

There are no receiving water monitoring requirements recommended at this time.

PART III – RATIONALE AND DERIVATION OF EFFLUENT LIMITATIONS & PERMIT CONDITIONS

305(B) REPORT, 303(d) LIST, & TOTAL MAXIMUM DAILY LOAD (TMDL):

Section 305(b) of the Federal CWA requires each state identify waters not meeting Water Quality Standards and for which adequate water pollution controls have not been required. Water Quality Standards protect such beneficial uses of water as whole body contact, maintaining fish and other aquatic life, and providing drinking water for people, livestock, and wildlife. The 303(d) list helps state and federal agencies keep track of waters which are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed which shall include the TMDL calculation. For facilities with an existing general permit before a TMDL is written on their receiving stream, the Department will evaluate the permit and may require any facility authorized by this general permit to apply for and obtain a site-specific operating permit.

ANTI-BACKSLIDING:

A provision in the Federal Regulations [CWA Section 303(d)(4); CWA Section 402(c); 40 CFR Part 122.44(I)] requires a reissued permit to be as stringent as the previous permit with some exceptions.

- ✓ Not Applicable: All effluent limitations in this permit are at least as protective as those previously established.

ANTIDEGRADATION:

Antidegradation policies ensure protection of water quality for a particular water body on a pollutant by pollutant basis to ensure Water Quality Standards are maintained to support beneficial uses such as fish and wildlife propagation and recreation on and in the water. This also includes special protection of waters designated as an Outstanding National Resource Water or Outstanding State Resource Water [10 CSR 20-7.031(3)(C)]. Antidegradation policies are adopted to minimize adverse effects on water.

The Department has determined the best avenue forward for implementing the Antidegradation requirements into general stormwater permits is by requiring the appropriate development and maintenance of a SWPPP. The SWPPP must identify all reasonable and effective BMPs, taking into account environmental impacts and costs. This analysis must document why no discharge or no exposure options are not feasible at the facility. This selection and documentation of appropriate control measures will then serve as the analysis of alternatives and fulfill the requirements of the Antidegradation Rule and Implementation Procedure 10 CSR 20-7.031(3) and 10 CSR 20-7.015(9)(A)5.

Any facility seeking coverage under this permit which undergoes expansion or discharges a new pollutant of concern must update their SWPPP and select reasonable and cost effective new BMPs. New facilities seeking coverage under this permit are required to develop a SWPPP including this analysis and documentation of appropriate BMPs. Renewal of coverage for a facility requires a review of the SWPPP to ensure the selected BMPs continue to be appropriate.

- ✓ Applicable; the facility must review and maintain stormwater BMPs as appropriate.

BENCHMARKS:

When a permitted feature or outfall consists of only stormwater, a benchmark may be implemented at the discretion of the permit writer. Benchmarks require the facility to monitor and, if necessary, replace and update stormwater control measures. Benchmark concentrations are not effluent limitations. A benchmark exceedance, therefore, is not a permit violation; however, failure to take corrective action is a violation of the permit. Benchmark monitoring data is used to determine the overall effectiveness of control measures and to assist the permittee in knowing when additional corrective actions may be necessary to comply with the limitations of the permit.

- ✓ Not applicable; this permit does not contain numeric benchmarks.

BEST MANAGEMENT PRACTICES (BMPs):

Minimum site-wide BMPs are established in this permit to ensure all permittees are managing their sites equally to protect waters of the state from certain activities which could cause negative effects in receiving water bodies. While not all sites require a SWPPP because the SIC codes are specifically exempted in 40 CFR 122.26(b)(14), these BMPs are not specifically included for stormwater purposes. These practices are minimum requirements for all industrial sites to protect waters of the state. If the minimum BMPs are not followed, the facility may violate general criteria [10 CSR 20-7.031(4)]. Statutes are applicable to all permitted facilities in the state; therefore, pollutants cannot be released unless in accordance with RSMo 644.011 and 644.016 (17).

CHANGES IN DISCHARGES OF TOXIC POLLUTANT:

This special condition reiterates the federal rules found in 40 CFR 122.44(f) and 122.42(a)(1). In these rules, the facility is required to report changes in amounts of toxic substances discharged. Toxic substances are defined in 40 CFR 122.2 as "...any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA." Section 307 of the CWA then refers to those parameters found in 40 CFR 401.15.

The permittee should also consider any other toxic pollutant in the discharge as reportable under this condition.

EFFLUENT LIMITATION GUIDELINE:

Effluent Limitation Guidelines, or ELGs, are found at 40 CFR 400-499. These are limitations established by the EPA based on the SIC code and the type of work a facility is conducting. Most ELGs are for process wastewater and some address stormwater. All are technology based limitations which must be met by the applicable facility at all times.

- ✓ The industries covered under this permit have an associated Effluent Limit Guideline (ELG) which is applicable to the stormwater discharges in this permit and is applied under 40 CFR 125.3(a).

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:

The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize CWA reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. The final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online.

- ✓ Applicable; this permit requires quarterly reports.

GENERAL CRITERIA CONSIDERATIONS:

In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into permits for pollutants determined to cause, have reasonable potential to cause, or to contribute to, an excursion above any water quality standard, including narrative water quality criteria. In order to comply with this regulation, the permit writer has completed a reasonable potential determination on whether discharges have reasonable potential to cause or contribute to an excursion of the general criteria listed in 10 CSR 20-7.031(4). In instances where reasonable potential exists, the permit includes limitations within the permit to address the reasonable potential. In discharges where reasonable potential does not exist, the permit may include monitoring to later determine the discharge's potential to impact the narrative criteria. Additionally, RSMo 644.076.1, as well as Standard Permit Conditions Part VIII of this permit state it shall be unlawful for any person to cause or allow any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule, or regulation promulgated by the commission.

LAND APPLICATION:

Land application, or surficial dispersion of wastewater and/or sludge, is performed by facilities to maintain a basin as no-discharge. Requirements for these types of operations are found in 10 CSR 20-6.015; authority to regulate these activities is from RSMo 644.026.

- ✓ Not applicable; this permit does not authorize operation of a surficial land application system to disperse wastewater or sludge.

LAND DISTURBANCE:

Land disturbance, sometimes called construction activities, are actions which cause disturbance of the root layer or soil; these include clearing, grading, and excavating of the land. 40 CFR 122.26(b)(14) and 10 CSR 20-6.200(3) requires permit coverage for these activities. Coverage is not required for facilities when only providing maintenance of original line and grade, hydraulic capacity, or to continue the original purpose of the facility.

- ✓ Applicable; this permit provides coverage for land disturbance activities. These activities have SWPPP requirements and may be combined with the standard site SWPPP. Land disturbance BMPs should be designed to control the expected peak discharges. The University of Missouri has design storm events for the 25 year 24 hour storm; these can be found at: http://ag3.agebb.missouri.edu/design_storm/comparison_reports/20191117_25yr_24hr_comparison_able.htm; to calculate peak discharges, the website <https://www.lmnoeng.com/Hydrology/rational.php> has the rational equation to calculate expected discharge volume from the peak storm events.

NUTRIENT MONITORING:

Nutrient monitoring is required for facilities characteristically or expected to discharge nutrients (nitrogenous compounds and/or phosphorus) when the design flow is equal to or greater than 0.1 MGD per 10 CSR 20-7.015(9)(D)8.

- ✓ This is a stormwater only permit; therefore, it is not subject to provisions found in 10 CSR 20-7.015 per 10 CSR 20-7.015(1)(C).

OIL/WATER SEPARATORS:

Oil water separator (OWS) tank systems are frequently found at industrial sites where process water and stormwater may contain oils and greases, oily wastewaters, or other immiscible liquids requiring separation. Food industry discharges typically require pretreatment prior to discharge to municipally owned treatment works. Per 10 CSR 26-2.010(2)(B), all oil water separator tanks must be operated according to manufacturer's specifications and authorized in NPDES permits per 10 CSR 26-2.010(2) or may be regulated as a petroleum tank.

- ✓ Not applicable; this permit does not authorize the operation of OWS. The facility must obtain a separate permit to cover operation of and discharge from these devices.

PERMIT SHIELD:

The permit shield provision of the CWA (Section 402(k)) and Missouri Clean Water Law (644.051.16 RSMo) provides that when a permit holder is in compliance with its NPDES permit or MSOP, they are effectively in compliance with certain sections of the CWA and equivalent sections of the Missouri Clean Water Law. In general, the permit shield is a legal defense against certain enforcement actions but is only available when the facility is in compliance with its permit and satisfies other specific conditions, including having completely disclosed all discharges and all facility processes and activities to the Department at time of application. It is the facility's responsibility to ensure that all potential pollutants, waste streams, discharges, and activities, as well as wastewater land application, storage, and treatment areas, are all fully disclosed to the Department at the time of application or during the draft permit review process. Subsequent requests for authorization to discharge additional pollutants or expanded or newly disclosed flows, or for authorization for previously unpermitted and undisclosed activities or discharges, will likely require permit modification or may require the facility be covered under a site specific permit.

PRETREATMENT PROGRAM:

This permit does not regulate pretreatment requirements for facilities discharging to an accepting permitted wastewater treatment facility. If applicable, the receiving entity (the publicly owned treatment works - POTW) must ensure compliance with any effluent limitation guidelines for pretreatment listed in 40 CFR Subchapter N per 10 CSR 20-6.100. Pretreatment regulations per RSMo 644.016 are limitations on the introduction of pollutants or water contaminants into publicly owned treatment works or facilities.

- ✓ Not Applicable; the facilities covered under this permit are not required to meet pretreatment requirements under an ELG.

PUBLIC NOTICE OF COVERAGE FOR AN INDIVIDUAL FACILITY:

Public Notice of reissuance of coverage is not required unless the facility is a specific type of facility as defined in 10 CSR 20-6.200(1). The need for an individual public notification process shall be determined and identified in the permit [10 CSR 20-6.020(1)(C)5.].

- ✓ Not applicable; public notice is not required for coverage under this permit to individual facilities. The MGP is public noticed in lieu of individual permit PN requirements.

REASONABLE POTENTIAL ANALYSIS (RPA):

Federal regulation 40 CFR Part 122.44(d)(1)(i) requires effluent limitations for all pollutants which are or may be discharged at a level which will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard. In accordance with 40 CFR Part 122.44(d)(iii) if the permit writer determines any given pollutant has the reasonable potential to cause or contribute to an in-stream excursion above the water quality standard, the permit must contain effluent limits for the pollutant.

- ✓ The permit writer reviewed industry materials, available past inspections, and other documents and research to evaluate general and narrative water quality reasonable potential for this permit. Permit writers also use the Department's permit writer's manual, the EPA's permit writer's manual (<https://www.epa.gov/npdes/npdes-permit-writers-manual>), program policies, and best professional judgment. For each parameter in each permit, the permit writer carefully considers all applicable information regarding technology based effluent limitations, effluent limitation guidelines, and water quality standards. Best professional judgment is based on the experience of the permit writer, cohorts in the Department and resources at the EPA, research, and maintaining continuity of permits if necessary. For stormwater permits, the permit writer is required per 10 CSR 6.200(6)(B)2 to consider: A. application and other information supplied by the permittee; B. effluent guidelines; C. best professional judgment of the permit writer; D. water quality; and E. BMPs.

SCHEDULE OF COMPLIANCE (SOC):

Per § 644.051, RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement or if prohibited by other statute or regulation. An SOC includes an enforceable sequence of interim requirements (e.g. actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the CWA, and 40 CFR 122.2. For new effluent limitations, the permit may include interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR 122.47(a)(1) and 10 CSR 20-7.031(11), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, an SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

- ✓ Not Applicable: This permit does not contain a SOC.

SETBACKS:

Setbacks, sometimes called separation distances, are common elements of permits and are established to provide a margin of safety in order to protect the receiving water and other features from accidents, spills, unusual events, etc. Specific separation distances are included in 10 CSR 20-8 for minimum design standards of wastewater structures. While wastewater is considered separately from stormwater under this permit, the guides and Chapter 8 distances may remain relevant to requirements under this permit if deemed appropriate by the permittee.

- ✓ Discharge to the watersheds of a Metropolitan No-Discharge Stream (10 CSR 20-7.031 Table F) is authorized by this permit if the discharges are in compliance with 10 CSR 20-7.015(5) and 10 CSR 20-7.031(7). Discharges to these watersheds are authorized for uncontaminated stormwater discharges only.
- ✓ This permit authorizes stormwater discharges which are located in a way to allow water to be released into sinkholes, caves, fissures, or other openings in the ground which could drain into aquifers (except losing streams) per 10 CSR 20-7.015(7). It is the best professional judgment of the permit writer to allow discharges to losing streams as the effluent is stormwater only.
- ✓ This permit authorizes stormwater discharge in the watersheds of Outstanding state Resource Waters (OSRW); Outstanding National Resources Waters (ONRW), which includes the Ozark National Riverways and the National Wild and Scenic Rivers System; and impaired waters as designated in the 305(b) Report provided no degradation of water quality occurs in the OSRW and ONRW due to discharges from the permitted facility per 10 CSR 20-7.015(6)(B) and 10 CSR 20-7.031(3)(C). Additionally, if the facility is found to be causing degradation or contributing to an impairment by discharging a pollutant of concern during an inspection or through complaint investigations, they will be required to become a no discharge facility or obtain a site specific permit with more stringent monitoring and SWPPP requirements. Missouri's impaired waters can be found at <https://dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/impaired-waters>. Sites within 1000 feet of a OSRW, ONRW, or water impaired for sediment must operate as a no-discharge facility. These additional protections are borrowed from the USEPA 2021 draft Construction General Permit.

SLUDGE – DOMESTIC BIOSOLIDS:

Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for beneficial use (i.e. fertilizer). Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including, but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works.

- ✓ This permit does not authorize discharge or land application of biosolids. Sludge/biosolids is not generated by this industry.

SLUDGE – INDUSTRIAL:

Industrial sludge is solid, semi-solid, or liquid residue generated during the treatment of industrial process wastewater in a treatment works; including, but not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment process; scum and solids filtered from water supplies and backwashed; and a material derived from industrial sludge.

- ✓ Not applicable; sludge is not generated by this industry.

SPILL REPORTING:

Any emergency involving a hazardous substance must be reported to the Department's 24 hour Environmental Emergency Response hotline at (573) 634-2436 at the earliest practicable moment after discovery. The Department may require the submittal of a written report detailing measures taken to clean up a spill. These reporting requirements apply when the spill results in chemicals or materials leaving the permitted property or reaching waters of the state. This requirement is in addition to the noncompliance reporting requirement found in Standard Conditions Part I. <https://dnr.mo.gov/waste-recycling/investigations-cleanups/environmental-emergency-response>.

Underground and above ground storage devices for petroleum products, vegetable oils, and animal fats may be subject to control under federal Spill Prevention, Control, and Countermeasure Regulation and are expected to be managed under those provisions, if applicable. Substances regulated by federal law under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which are transported, stored, or used for maintenance, cleaning or repair shall be managed according to the provisions of RCRA and CERCLA.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):

In accordance with 40 CFR 122.44(k), BMPs must be used to control or abate the discharge of pollutants when: 1) Authorized under section 304(e) of the CWA for the control of toxic pollutants and hazardous substances from ancillary industrial activities; 2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; 3) Numeric effluent limitations are infeasible; or 4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA. In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites*, (Document number EPA 833-R-06-004) published by the EPA in 2007 https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf, BMPs are measures or practices used to reduce the amount of pollution entering waters of the state from a permitted facility. BMPs may take the form of a process, activity, or physical structure. Additionally, in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to 1) identify sources of pollution or contamination, and 2) select and carry out actions which prevent or control the pollution of storm water discharges. Additional information can be found in *Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices* (EPA 832-R-92-006; September 1992).

A SWPPP must be prepared if the SIC code for the facility is found in 40 CFR 122.26(b)(14) and/or 10 CSR 20-6.200(2). A SWPPP may be required of other facilities where stormwater has been identified as necessitating better management.

The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff. Developing a SWPPP provides opportunities to employ appropriate BMPs to minimize the risk of pollutants being discharged during storm events. The following paragraph outlines the general steps the permittee should take to determine which BMPs will work to achieve the benchmark values or limits in the permit. This section is not intended to be all encompassing or restrict the use of any physical BMP or operational and maintenance procedure assisting in pollution control. Additional steps or revisions to the SWPPP may be required to meet the requirements of the permit.

Areas which should be included in the SWPPP are identified in 40 CFR 122.26(b)(14). Once the potential sources of stormwater pollution have been identified, a plan should be formulated to best control the amount of pollutant being released and discharged by each activity or source. This should include, but is not limited to, minimizing exposure to stormwater, good housekeeping measures, proper facility and equipment maintenance, spill prevention and response, vehicle traffic control, and proper materials handling. Once a plan has been developed, the facility will employ the control measures determined to be adequate to prevent pollution from entering waters of the state. The facility will conduct inspections of the BMPs to ensure they are working properly and re-evaluate any BMP not achieving compliance with permitting requirements. For example if the BMP being employed is deficient in controlling stormwater pollution, corrective action should be taken to repair, improve, or replace the failing BMP. If failures do occur, continue this trial and error process until appropriate BMPs have been established.

The EPA has developed factsheets on the pollutants of concern for specific industries along with the BMPs to control and minimize stormwater (<https://www.epa.gov/npdes/stormwater-discharges-industrial-activities>). Along with EPA's factsheets, the International Stormwater BMP database (<https://bmpdatabase.org/>) may provide guidance on BMPs appropriate for specific industries.

For new, altered, or expanded stormwater discharges, the SWPPP shall identify reasonable and effective BMPs while accounting for environmental impacts of varying control methods. The antidegradation analysis must document why no discharge or no exposure options are not feasible. The selection and documentation of appropriate control measures shall serve as an alternative analysis of technology and fulfill the requirements of antidegradation [10 CSR 20-7.031(3)].

Alternative analysis evaluation of the BMPs is a structured evaluation of BMPs which are reasonable and cost effective. The alternative analysis evaluation should include practices designed to be: 1) non-degrading; 2) less degrading; or 3) degrading water quality. The glossary of the *Antidegradation Implementation Procedure* defines these three terms. The chosen BMP will be the most reasonable and effective management strategy while ensuring the highest statutory and regulatory requirements are achieved and the highest quality water attainable for the facility is discharged. The alternative analysis evaluation must demonstrate why "no discharge" or "no exposure" is not a feasible alternative at the facility. This structured analysis of BMPs serves as the antidegradation review, fulfilling the requirements of 10 CSR 20-7.031(3) Water Quality Standards and *Antidegradation Implementation Procedure*, Section II.B.

- ✓ Applicable: A SWPPP shall be developed and implemented for each site and shall incorporate required practices identified by the Department with jurisdiction, incorporate control practices specific to site conditions, and provide for maintenance and adherence to the plan.

UNDERGROUND INJECTION CONTROL (UIC):

The UIC program for all classes of wells in the State of Missouri is administered by the Missouri Department of Natural Resources and approved by EPA pursuant to section 1422 and 1425 of the Safe Drinking Water Act (SDWA) and 40 CFR 147 Subpart AA. Injection wells are classified based on the liquids which are being injected. Class I wells are hazardous waste wells which are banned by RSMo 577.155; Class II wells are established for oil and natural gas production; Class III wells are used to inject fluids to extract minerals; Class IV wells are also banned by Missouri in RSMo 577.155; Class V wells are shallow injection wells; some examples are heat pump wells and groundwater remediation wells. Domestic wastewater being disposed of sub-surface is also considered a Class V well.

In accordance with 40 CFR 144.82, construction, operation, maintenance, conversion, plugging, or closure of injection wells shall not cause movement of fluids containing any contaminant into Underground Sources of Drinking Water (USDW) if the presence of any contaminant may cause a violation of drinking water standards or groundwater standards under 10 CSR 20-7.031 or other health-based standards or may otherwise adversely affect human health. If the Department finds the injection activity may endanger USDWs, the Department may require closure of the injection wells or other actions listed in 40 CFR 144.12(c), (d), or (e). In accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes, to the Missouri Department of Natural Resources, Geological Survey Program, P.O. Box 250, Rolla, Missouri 65402. Single family residential septic systems and non-residential septic systems used solely for sanitary waste and having the capacity to serve fewer than 20 persons a day are excluded from the UIC requirements (40 CFR 144.81(9)).

- ✓ Not applicable; this permit does not authorize subsurface wastewater systems or other underground injection. These activities must be assessed under an application for a site specific permit. Certain discharges of stormwater into sinkholes may qualify as UIC. It is important the permittee evaluate all stormwater basins, even those holding water; as sinkholes have varying seepage rates. This permit does not allow stormwater discharges into sinkholes. The facility must ensure sinkholes are avoided in the construction process. The State's online mapping resource <https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=87ebef4af15d438ca658ce0b2bbc862e> has a sinkhole layer.

VARIANCE:

Per the Missouri Clean Water Law Section 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law Section 644.006 to 644.141 or any standard, rule, or regulation promulgated pursuant to Missouri Clean Water Law Section 644.006 to 644.141.

- ✓ Not Applicable: This permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITATIONS:

Per 10 CSR 20-2.010(78), the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant which may be discharged into the stream without endangering its water quality. Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's Technical Support Document For Water Quality-based Toxics Control (TSD) (EPA/505/2-90-001).

- ✓ Not applicable; water quality limitations were not applied in this permit.

WATER QUALITY STANDARDS:

Per 10 CSR 20-7.031(4), General Criteria shall be applicable to all waters of the state at all times, including mixing zones. Additionally, 40 CFR 122.44(d)(1) directs the Department to include in each NPDES permit conditions to achieve water quality established under Section 303 of the CWA, including state narrative criteria for water quality.

WHOLE EFFLUENT TOXICITY (WET) TEST:

Per 10 CSR 20-7.031(1)(FF), a toxicity test conducted under specified laboratory conditions on specific indicator organism; and per 40 CFR 122.2, the aggregate toxic effect of an effluent measured directly by a toxicity test. A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with, or through synergistic responses when mixed with receiving water.

- ✓ Not applicable: At this time, permittees are not required to conduct a WET test. This permit is for stormwater only.

PART IV – EFFLUENT LIMITATIONS DETERMINATION

EPA Construction General Permit (CGP)

The CGP was used to research and support best professional judgment decisions made in establishing technology-based conditions for this general permit which are consistent with national standards. The permit writer determined the standards established by the CGP are achievable and consistent with federal regulations. Additionally, the conditions reflecting the best practicable technology currently available are utilized to implement the ELG.

In this general permit, technology-based effluent conditions are established through the SWPPP and BMP requirements. Effective BMPs should be designed on a site-specific basis. The implementation of inspections provides a tool for each facility to evaluate the effectiveness of BMPs to ensure protection of water quality. Any flow through an outfall is considered a discharge. Future permit action due to permit modification may contain new operating permit terms and conditions which supersede the terms and conditions, including effluent limitations, of this operating permit.

PART V–REPORTING REQUIREMENTS

SAMPLING:

The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities at the facility. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

REPORTING:

There are quarterly reporting requirements for MO-R100xxx land disturbance permits. Project specific information is required to be report to the Department through the eDMR system.

PART VI – RAINFALL VALUES FOR MISSOURI & SURFACE WATER BUFFER ZONES

Knowledge of the 2-year, 24-hour storm event is used in this permit for two main reasons:

- 1) The design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants.
- 2) If the seven-day inspection frequency is utilized, an inspection must occur within 48 hours after any storm event equal to or greater than a 2-year, 24 hour storm has ceased.

For site-specific 2-year, 24-hour storm event information utilize the National Oceanic and Atmospheric Administration’s National Weather Service Atlas 14 (NOAA Atlas 14) which is located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. For more information visit; https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume8.pdf.

Surface Water Buffer Zones: In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of natural buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, steepness, and the types of erosion and sediment controls used to reduce the discharge of sediment prior to the buffer. For additional information;

https://www.epa.gov/sites/default/files/2017-02/documents/2017_cgp_final_appendix_g_-_buffer_reqs_508.pdf

PART VII – ADMINISTRATIVE REQUIREMENTS

On the basis of preliminary staff review and applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the permit. The proposed determinations are tentative pending public comment.

PUBLIC MEETING:

The department hosted three public meetings for this permit. The meetings were held on January 27, February 17, and March 9, 2021.

PUBLIC NOTICE:

The Department shall give public notice when a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest or because of water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and facility must be notified of the denial in writing.

The Department must give public notice of a pending permit or of a new or reissued Missouri State Operating Permit. The public comment period is a length of time not less than thirty (30) days following the date of the public notice, during which interested persons may submit written comments about the proposed permit.

For persons wanting to submit comments regarding this proposed permit, please refer to the Public Notice page located at the front of this draft permit. The Public Notice page gives direction on how and where to submit appropriate comments.

- ✓ The Public Notice period for this permit is started March 25, 2022 and ended April 25, 2022. Two comment letters were received.

DATE OF FACT SHEET: 03/2/2022

COMPLETED BY:

SARAH WRIGHT

MS4 & LAND DISTURBANCE PERMITTING COORDINATOR

MISSOURI DEPARTMENT OF NATURAL RESOURCES

WATER PROTECTION PROGRAM

OPERATING PERMITS SECTION - STORMWATER AND CERTIFICATION UNIT

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