PROJECT MANUAL FOR
PRV AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WI

November 2025

Project #07985049.2

Prepared By:

MSA Professional Services, Inc.
1230 South Boulevard
Baraboo, WI 53913

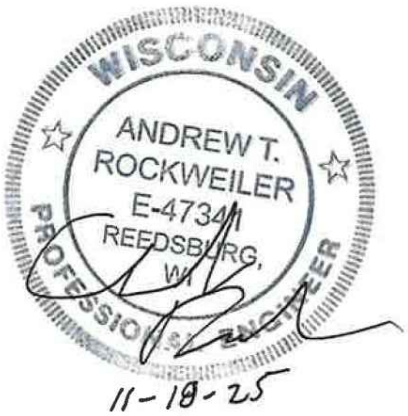
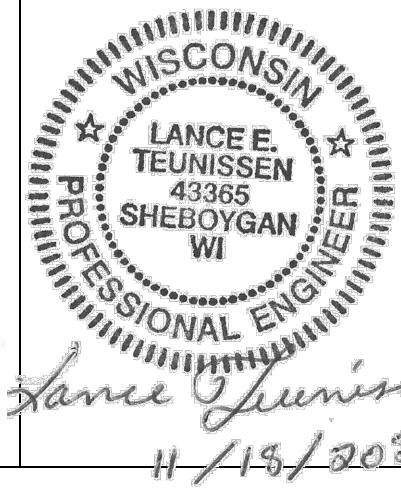
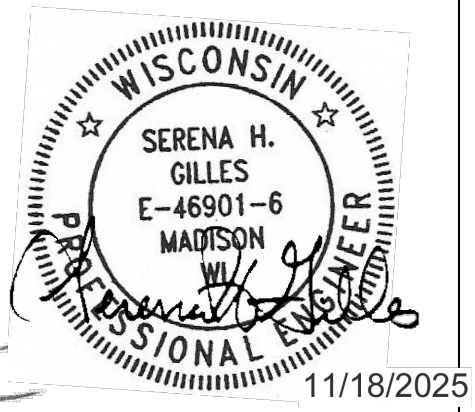
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PRV and BOOSTER STATION

City of New Richmond
St. Croix County, WI

Project #07985049.2

Seals Page

GENERAL PROCESS ENGINEER: MSA Professional Services, Inc.	ELECTRICAL MSA Professional Services, Inc.	STRUCTURAL: MSA Professional Services, Inc.
		

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ADVERTISEMENT FOR BIDS
PRV AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WI

CITY OF NEW RICHMOND is requesting Bids for the construction of the following Project:

PRV AND BOOSTER STATION
Project #07985049.2

The City Of New Richmond will receive and accept bids ONLY through QuestCDN.com via the online electronic bid service (QuestvBid) for the construction of PRV and Booster Station until December 18, 2025, at 11:00 a.m. All bids will be downloaded and publicly read aloud during a virtual public bid opening that will be held at the day and time of the bid closing. All plan holders will receive information via Quest on how to join the virtual meeting prior to the bid opening.

The Project includes the following Work: construction of a pressure reducing valve (PRV) station, and booster station, including but not limited to; all site work, electrical, and water main connections to the existing system.

The anticipated substantial completion date is September 1, 2027, and final completion date is December 31, 2027.

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website: www.questcdn.com

Bidding Documents are available for download from QuestCDN at www.questcdn.com. You may download the digital plan documents for $45 by inputting Quest eBidDoc #9275437 on the website's Project Search page. Please contact QuestCDN at 952-233-1632 or contact by email at info@questcdn.com for assistance in free membership registration, downloading, and working with the digital project information. Prospective Bidders are urged to register with QuestCDN as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. QuestCDN requires the bidding documents to be downloaded from the site in order to submit a bid in the Vbid system. The designated website will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through QuestCDN. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than QuestCDN.

Instructions to Bidders.

No proposal will be accepted unless accompanied by a certified check or bid bond equal to at least 5% of the amount bid, payable to the Owner as a guarantee that, if the bid is accepted, the bidder will execute and file the proper contract and bond within 15 days after the award of the contract. The certified check or bid bond will be returned to the bidder as soon as the contract is signed, and if after 15 days the bidder shall fail to do so, the certified check or bid bond shall be forfeited to the Owner as liquidated damages.

No bidder may withdraw their bid within 60 days after the actual date of the opening thereof.

Owner reserves the right to waive any informalities or to reject any or all bids.

Published by the authority of the City of New Richmond.

CONSULTING ENGINEER:
MSA Professional Services, Inc.
1230 South Boulevard
Baraboo, WI 53913
Andrew Rockweiler, PE
arockweiler@msa-ps.com | (608) 355-8877

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. Issuing Office - The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

2.05 Electronic Documents

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version 2017 Standard/Pro or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer

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cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within 5 days of Owner's request, Bidder shall submit (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:

A. Evidence of Bidder's authority to do business in the state where the Project is located.

B. Bidder's state or other contractor license number, if applicable.

C. Subcontractor and Supplier qualification information.

D. No contractor or subcontractor may work on this project who is currently debarred either Federally or in the State of Wisconsin.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4 - PRE-BID CONFERENCE

4.01 A pre-bid conference will not be conducted for this Project.

ARTICLE 5 - SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE, OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions.

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

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Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 Other Site-related Documents

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

1. NONE

Owner will make copies of these other Site-related documents available to any Bidder on request.

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

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5.04 Site Visit and Testing by Bidders

A. Bidders visiting the Site are required to arrange their own transportation to the Site.

B. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: Dave Pufall/City of New Richmond Water Superintendent

C. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

D. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

E. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

F. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 Owner's Safety Program

A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6 - BIDDER'S REPRESENTATIONS

6.01 Express Representations and Certifications in Bid Form, Agreement

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

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B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

Andrew Rockweiler, PE, arockweiler@msa-ps.com | (608) 355-8877

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5% or 10% of Bidder's maximum Bid price and in the form of a certified check, or an electronic Bid Bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Bidder is required to deliver the original certified check or bid bond within the 72 hours of bid opening to MSA Professional Services, Inc., Attn: Andrew Rockweiler, PE

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

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ARTICLE 10 - SUBSTITUTE AND "OR-EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

11.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within 24-hours after Bid opening:

A. Pre-fabricated booster station, pre-fabricated PRV station

11.03 If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased *(or decreased)* by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

ARTICLE 12 - PREPARATION OF FORM

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid form shall be completed and submitted via QUESTvBID.

12.02 Bidder shall complete and submit required attachments as listed in the Bid Form.

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12.03 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

12.06 A Bid by an individual shall show the Bidder's name and official address.

12.07 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture shall be shown.

12.08 All names shall be printed in ink below the signatures.

12.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

ARTICLE 13 - BASIS OF BID

13.01 Base Bid with Alternates

A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount [added to] or [deleted] from the base Bid if Owner selects the alternate.

B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

13.02 Allowances

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 14 - SUBMITTAL OF BID

14.01 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bid or Invitation to Bid, and shall be accompanied by the Bid security and other required documents. Bids will ONLY be received and accepted via the online electronic bid service through QuestCDN (www.QuestCDN.com). To access the electronic bid form, download the project documents and click the online bidding button at the top of the advertisement. If you need further assistance, please feel free to contact QuestCDN at (952) 233-1632.

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14.02 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15 - MODIFICATION AND WITHDRAWAL OF BID

15.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 16 - OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18 - EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid which Owner determines to be in the best interest of the project.

18.05 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

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B. The Bid contains additive bid alternates. The alternate bids will be used to shape the project to fit the budget. The Owner reserves to right to award the Contract on the base bid and any combination of the bid alternates

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19 - BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20 - SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21 - SALES AND USE TAXES

21.01 Owner represents that it is a qualifying exempt entity under Section 77.54(9m), Wis. Stats. (as created by 2015 Wis. Act 126) with respect to exemption from Wisconsin sales and use tax of certain items that become part of eligible facilities owned by the qualifying exempt entity. The Bid shall account for such sales and use tax exemptions, to the extent applicable. The Contract will provide that the Contractor is not entitled to an increase in Contract Price if Contractor is not successful in obtaining an anticipated sales and use tax exemption, unless the reason for the inability to obtain the anticipated exemption is a formal determination by the State of Wisconsin that Owner is not a qualifying exempt entity.

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AVAILABLE PROJECT INFORMATION

Geotechnical Report

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C V T

Chosen Valley Testing

Design Phase Geotechnical Evaluation:

Proposed Booster Station
Brady Lane
New Richmond, Wisconsin

Prepared for:

Erik Evenson, Director of Public Works
City of New Richmond

c/o MSA Professional Services

April 26, 2024
CVT Project: 23366.24.WIL

WISCONSIN COLBY T. VERGEGAN E-36326 CHATFIELD, MN PROFESSIONAL ENGINEER	I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly registered engineer under the laws of the State of Wisconsin. Colby T. Verdegan, PE Geotechnical Engineer Registration Number 36326 Date: April 26, 2024

Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing • 1019 2nd Ave. SW, Onalaska, WI 54650 • Phone (608) 782-5505 • Fax (608) 785-2818
E-mail: lacrosse@chosenvalleytesting.com

Erik Evenson
Director of Public Works
City of New Richmond
156 E. 1st Street
New Richmond, WI 54017

April 26, 2024

c/o: Justin Yanke
MSA Professional Services, Inc
1230 South Boulevard
Baraboo, WI 53913
Email: jyanke12@mas-ps.com

Re: Design Phase for Geotechnical Evaluation
Proposed Booster Station
Brady Lane
New Richmond, Wisconsin
CVT Project 23366.24.WIL

Dear Mr. Evenson,

As authorized, we have completed the design phase geotechnical evaluation for the proposed booster station in New Richmond, Wisconsin. This letter briefly summarizes the findings in the attached report.

Summary of Boring Results

The borings initially encountered about 1 foot of topsoil at the surface.

Beneath the topsoil, borings initially met a foot layer of silty sand, followed by rather clean sands with little silt or clay to about 14 feet. The deeper soils consisted of additional silty sand.

Water was observed in both borings at depths of about 12 to 15 feet below the surface. Groundwater levels on site would be expected to fluctuate seasonally, similar to levels in nearby ponds and lakes, along with local weather patterns.

Summary of Analysis and Recommendations

Based on the borings, the general soils appear to consist of topsoil and dark B-Horizon silty sands, over relatively rather clean natural sands with silty sands at depth. The topsoil materials are not suitable for foundation support and should be removed from below the structure.

If a monolithic foundation were used, the underlying B-Horizon soils are highly frost-susceptible and would have to be removed as well to expose the underlying clean sands. The clean sands appear to meet typical requirements for non-frost-susceptible soils. For ease in construction and to meet typical requirements for non-frost-susceptible soils, replacement soils for either approach are recommended to consist of clean sands having less than 6% particles passing a #200 sieve.

Based on the data and proper implementation of our recommendations, the bearing soils are expected to be suitable for support of foundations designed to exert pressure of up to 3,000 pounds per square foot. Actual loads are expected to be much less. The remaining sections of this report provide more details of our recommendations.

Remarks

We appreciate the opportunity to serve you. The attached report provides more details of our analysis. If you have any questions about our report, please feel free to contact us at (651) 756-7384.

Sincerely,
Chosen Valley Testing, Inc.



Hannah Fischer
Graduate Geological Engineer



Colby T. Verdegan, PE
Sr. Geotechnical/Materials Engineer

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Appendix 8

Design Phase Geotechnical Evaluation
Proposed Booster Station
Brady Lane
New Richmond, Wisconsin

CVT Project Number: 23366.24.WIL
Date: April 26, 2024

A. Introduction

The intent of this report is to present our findings to the client in the same logical sequence that led us to arrive at the opinions and recommendations expressed. Since our services often must be completed before the design is finished, assumptions are often needed to prepare a proper scope and to analyze the data. A complete and thorough review of the entire document, including its assumptions and its appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This geotechnical report was prepared to assist planning for the proposed booster station for the City of New Richmond, Wisconsin. Our services were authorized by Erik Evenson, Director of Public Works for the City. MSA Professional Services (MSA) is the city's design consultant.

A.2. Scope

To obtain data for analysis, we were authorized to perform two penetration test borings to depths of about 20 feet. Our engineering scope consisted of providing this report summarizing our exploration procedures, findings and geotechnical recommendations for the proposed structure.

A.3. Boring Locations and Elevations

The boring locations were indicated to Chosen Valley Testing, Inc. (CVT) on a plan from MSA and were staked in the field by MSA. The Boing Location sketch in the Appendix of this report shows the approximate boring locations as drilled and was created by superposing the plans provided onto a satellite view of the site using Google Earth software. Ground surface elevations are the borings were indicated on the boring location plan from MSA.

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Geologic maps of the area indicate the dominant soils are granular glacial melt out soils (Copper Fall diamicton). The depth to bedrock appears to be rather variable. The uppermost bedrock is indicated to be primarily the dolostone from the highly variable and fractured Shakopee Formation or the underlying, more uniform and massive Oneota Formation.

B. Subsurface Data

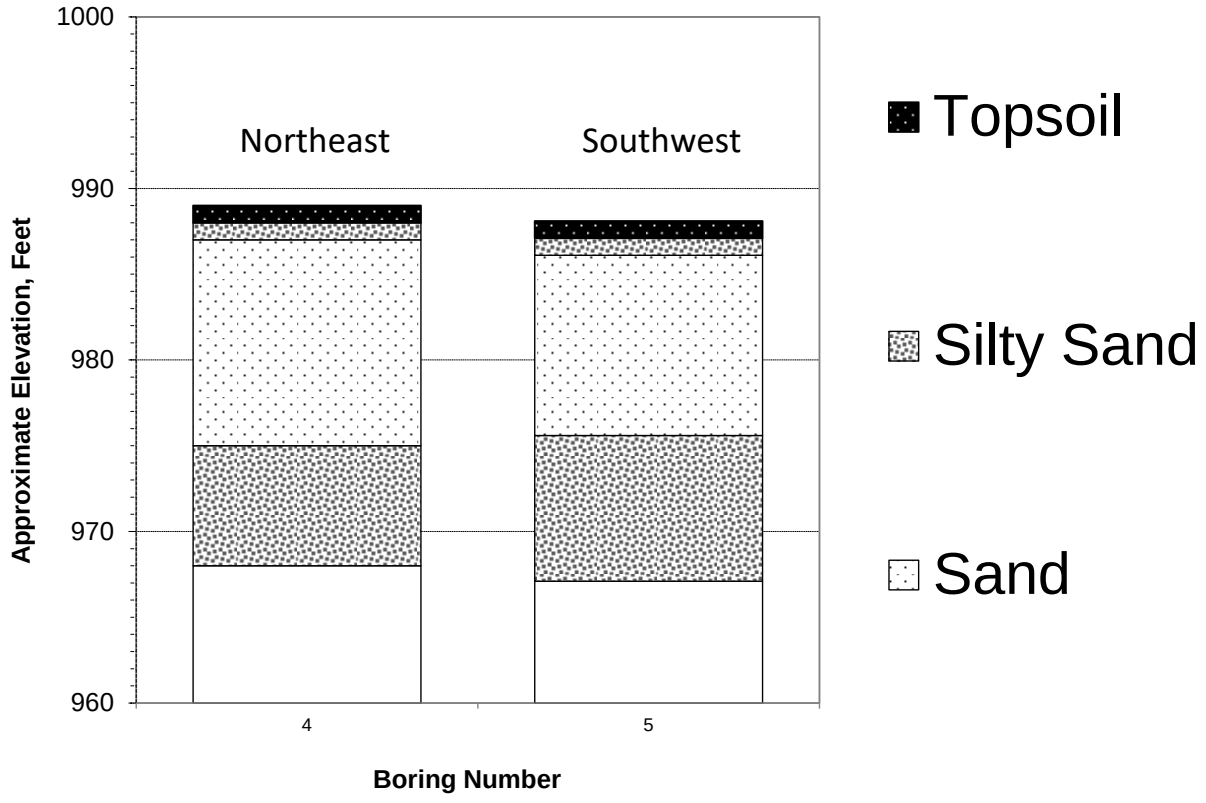
Procedures: The borings were performed using penetration test procedures (Method of Test D1586 of the American Society for Testing and Materials). This procedure allows for the extraction of intact soil specimen from deep in the ground. With this method, a hollow-stem auger is drilled to the desired sampling depth. A 2-inch OD sampling tube is then screwed onto the end of a sampling rod, inserted through the hole in the auger's tip, and then driven into the soil with a 140-pound hammer dropped repeatedly from a height of 30 inches above the sampling rod. The sampler is driven 18 inches into the soil, unless the material is too hard. The samples are generally taken at 2 ½ to 5-foot intervals. The core of soil obtained was classified and logged by the driller on site and a representative portion was then sealed and delivered to the geotechnical engineer for further review.

B.1. Stratification

The borings initially encountered about 1 foot of topsoil at the surface.

Beneath the topsoil, borings initially met a foot layer of silty sand, followed by rather clean sands with little silt or clay to about 14 feet. The deeper soils consisted of additional silty sand.

A generalized cross section is provided below. The Log of Boring sheets included in the Appendix should be reviewed for more detailed information.



B.2. Penetration Test Results

The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The results tend to be more meaningful for natural mineral soils than for fill soils. In fill soils, compaction tests are more meaningful.

Penetration resistance values ("N" Values) in the soils ranged from 2 to 13 blows per foot (BPF), indicating they were very loose to medium dense. The lowest values were from below the water table, and this is very common.

B.3. Groundwater Data

During drilling, the drillers may note the presence of moisture on the sampler, in the cuttings, or in the borehole itself. These findings are reported on the boring logs. Because water levels vary with weather, time of year, and other factors, the presence or lack of water during exploration is subject to interpretation and is not always conclusive.

Water was observed in both borings at depths of about 12 to 15 feet below the surface. Groundwater levels on site would be expected to fluctuate seasonally, similar to levels in nearby ponds and lakes, along with local weather patterns.

C. Design Data

Because each structure has a different loading configuration and intensity, different grades, and different structural or performance tolerances, the results of a geotechnical exploration will mean different things for different facilities. If the facility changes, the soils engineer should be contacted to discuss possible implications of the changes. Without a chance to review such changes, the recommendations of the soils engineer may no longer be valid or appropriate.

The structure will be a one-story structure with a superstructure consisting of masonry or precast walls and a steel or precast roof. A monolithic foundation is preferred or, alternatively, frost depth spread footing foundations. Maximum loads along the wall lines are assumed to be less than 3,000 pounds per lineal foot.

D. Analysis

Based on the borings, the general soils appear to consist of topsoil and dark B-Horizon silty sands, over relatively rather clean natural sands with silty sands at depth. The topsoil materials are not suitable for foundation support and should be removed from below the structure.

If a monolithic foundation were used, the underlying B-Horizon soils are highly frost-susceptible and would have to be removed as well to expose the underlying clean sands. The clean sands appear to meet typical requirements for non-frost-susceptible soils. For ease in construction and to meet typical requirements for non-frost-susceptible soils, replacement soils for either approach are recommended to

consist of clean sands having less than 6% particles passing a #200 sieve.

Based on the data and proper implementation of our recommendations, the bearing soils are expected to be suitable for support of foundations designed to exert pressure of up to 3,000 pounds per square foot. Actual loads are expected to be much less. The remaining sections of this report provide more details of our recommendations.

E. Recommendations

E.1. Grading Recommendations

E.1.a. Removal Options: We recommend removing the topsoil from below the structure. At the locations explored, about 1 foot of topsoil removal would be expected.

If the monolithic foundation option is used, the underlying B-Horizon layer must also be removed. At the locations explored, about 1 foot of additional excavation would be expected to remove the B-Horizon soils.

E.1.b. Subgrade Evaluation: Based on the borings, the soils at assumed bearing elevations are expected to be suitable for direct support of foundations. Chosen Valley Testing should be retained to evaluate the actual materials when they are exposed. Subject to these observations, changes to the earthwork recommendations may be deemed warranted, but are not expected.

E.1.c. Oversizing: In the event soils corrections are deemed warranted, corrective excavations should be oversized at least 1-foot horizontally beyond the edge of foundations for each foot of fill needed below footings or the monolithic slab foundation. This oversizing can be reduced by up to 50% if rather precise staking is present during grading, and the excavation limits can be rather precisely confirmed relative to the foundations.

E.1.d. Filling and Compaction: We recommend using clean sands or gravels having less than 6% particles passing a #200 sieve where fill is needed below the foundation. The natural poorly graded sands would be expected to meet this gradation. Proposed import fill materials should be evaluated by CVT prior to its use.

All fill should be placed in lifts adjusted to the compactor being used and the material being compacted. We recommend limiting lifts to no more than 1-foot – assuming large, self-propelled or tow-behind compactors are used. All fill materials below the structure, in the oversized areas, or used as backfill for walls should be compacted to a minimum of 95% of its maximum standard Proctor density (ASTM D 698).

E.2. Building Design

E.2.a. Foundation Depth: Footings for unheated structures should be placed at least 60 inches below the

exposed ground surface. If the frost zone soils consist of clean, non-frost-susceptible soils, frost depth footings should not be necessary. Alternatively, insulation could also be used.

E.2.b. Bearing Capacity: Based on the assumed loads and implementation of the earthwork recommendations, we are of the opinion that foundations may be designed to exert pressures of up to 3,000 psf. This allowable bearing capacity includes a safety factor of at least 3 against shear failure.

E.2.c. Settlement: Based on the boring data and proper implementation of our recommendations, total settlement is expected to be on the order of ½ inch or less.

E.2.d. Slab Design: Slab subgrades near the surface are expected to bear on clean, compacted sand. We recommend using a modulus of subgrade reaction of no more than 200 pounds per cubic inch (pci) for these conditions.

F. Utilities

F.1. De-watering

Water was observed at depths of about 12 to 15 feet. Dewatering would likely be needed if utility installations extend that deep.

F.2. Side-Slopes

The sides of the trenches will have to be sloped or shored as needed to provide a safe condition for conducting the work. The soils that dominate the site would likely classify as Type C soils as defined by OSHA.

F.3. General Support and Stability

The utilities are expected to bear on sands or silty sands. These materials are expected to provide adequate support for the utilities.

F.4. Fill Placement and Compaction

Soils placed as backfill should be compacted to the densities required with respect to overlying structures: Fill below pavements should be compacted to 95% of its maximum standard Proctor density. In green areas, compaction to 90% is usually sufficient.

G. Construction Recommendations

G.1. Excavation

We recommend using a backhoe with a smooth lipped bucket to excavate the soils.

G.2. Cold Weather

If site grading is anticipated during cold weather, we recommend that good winter construction practices be observed. All snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on soils that have frozen or contain frozen material. Frozen soils should not be used as fill.

G.3. Testing and Documentation

Ideally, the excavations should be evaluated and documented by qualified personnel. If the filling proceeds during periods of freezing weather, full-time testing should be considered to help confirm that imported fill is thawed prior to and during compaction, and that all snow has been removed before placement of the fill.

Although our firm offers testing services relating to structural components of the project (such as concrete testing, reinforcement observations, etc.), specification of such services is beyond our work scope and the designer(s) should be consulted as to such requirements.

H. Level of Care

The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix

Boring Location Sketch

Log of Boring # 4-5

Legend to Soil Description

C V T

Chosen Valley Testing, Inc.

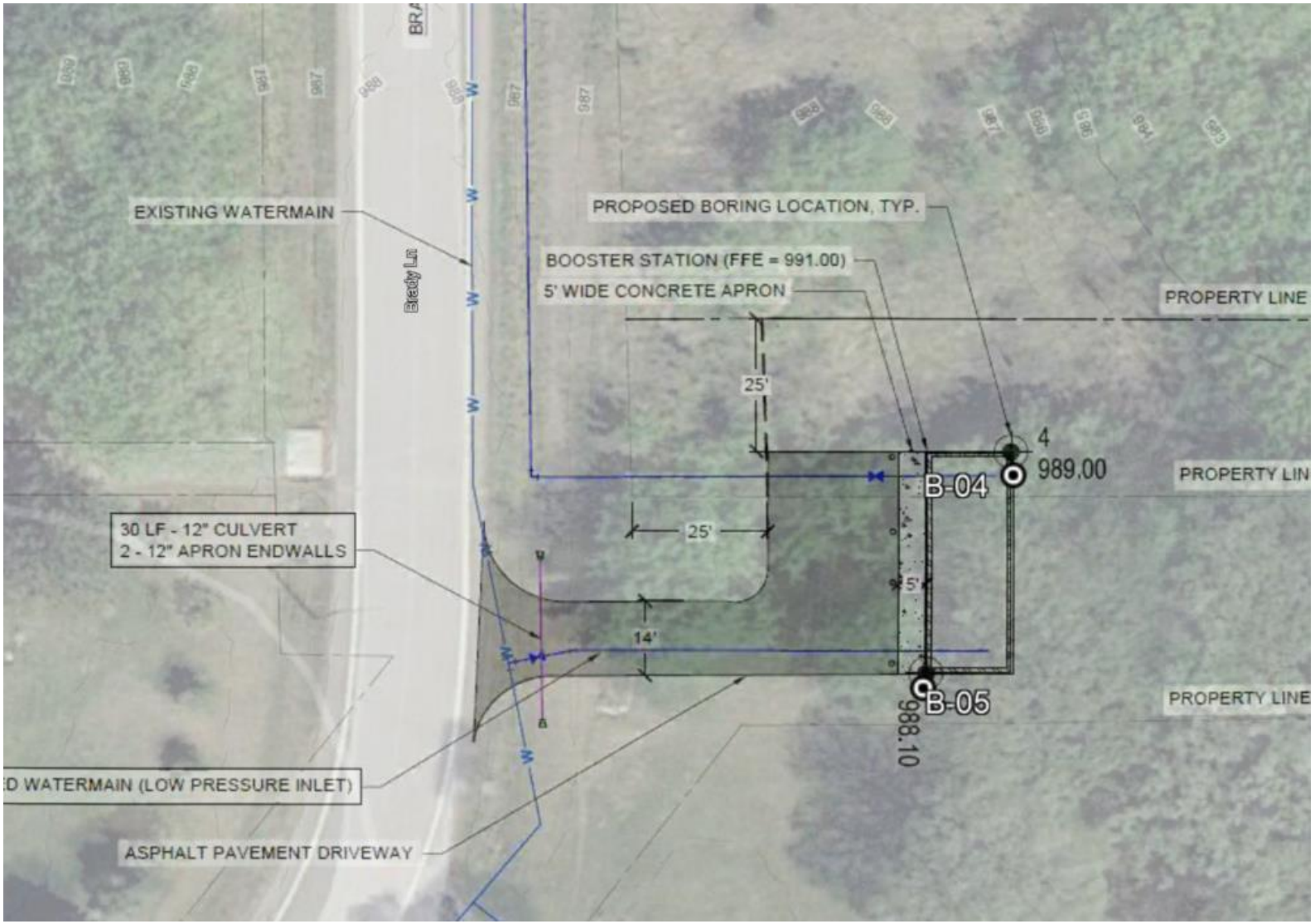
Legend

Boring Locations

N

Boring Location Sketch

Water Tower #3 and Booster Station
Brady Lane
New Richmond, WI
CVT Project 23366.24.WIL



LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 23366.24.MNT Design Phase Geotechnical Evaluation Water Tower #3 and Lift Station New Richmond New Richmond, Wisconsin	BORING: **B-04** LOCATION: See attached sketch. DATE: 4/2/2024 SCALE: 1" = 5'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
989.0	0.0					
988.0	1.0	OL	**TOPSOIL**, Slightly Organic Silty Sand, trace Roots, dark brown, moist.			
987.0	2.0	SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist. (B-Horizon)	8		MC=4.5%
		SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist to 12 feet then water bearing, loose. (Glacial Outwash)	8		MC=3.9%
				9		MC=10.3%
				7		MC=11.5%
				6		MC=12.6%
975.0	14.0					
		SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist, very loose, wet. (Glacial Till)	5	▽	MC=12.8%
968.0	21.0			4		MC=13.4%
			End boring. Water was observed at 15 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 23366.24.WIL (NEW RICHMOND WATER TOWER 3 AND BOOSTER STATION).GPJ LOG A GNNN06.GDT 4/16/24

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 23366.24.MNT Design Phase Geotechnical Evaluation Water Tower #3 and Lift Station New Richmond New Richmond, Wisconsin	BORING: **B-05** LOCATION: See attached sketch. DATE: 4/2/2024 SCALE: 1" = 5'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
988.1	0.0					
987.1	1.0	OL	**TOPSOIL**, Slightly Organic Silty Sand, trace Roots, dark brown, moist.			
986.1	2.0	SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist. (B-Horizon)	12		MC=9.4%
		SP	**POORLY GRADED SAND**, fine-to-medium grained, trace Gravel, brown, moist to 12 feet then water bearing, loose. (Glacial Outwash)	13		MC=9.2%
				7		MC=7%
				7		MC=14%
975.6	12.5				▽	
		SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist, very loose, wet. (Glacial Till)	4		
				6		MC=16.7%
967.1	21.0			2		MC=15.9%
			End boring. Water was observed at 12 feet during drilling. Boring was sealed upon completion.			

UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

Relative Proportions of Sand and Gravel

TERM	PERCENT
Trace	< 15
With	15 - 29
Modifier	> 30

Relative Proportions of Fines

TERM	PERCENT
Trace	< 5
With	5 - 12
Modifier	> 12

Grain Size Terminology

TERM	SIZE
Boulder	< 12 in.
Cobble	3 in. - 12 in.
Gravel	#4 sieve to 3 in.
Sand	#200 sieve to #4 sieve
Silt or Clay	Passing #200 sieve

SAMPLE TYPES

Hollow Stem

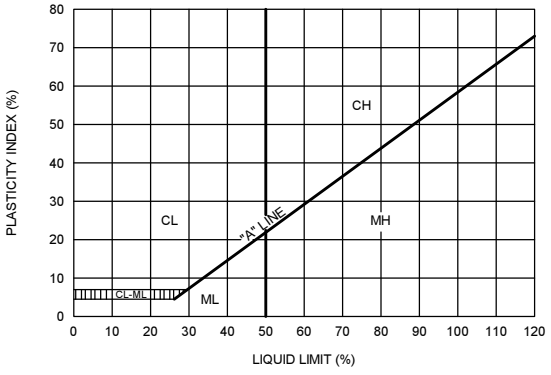
Standard Penetration Test

TEST SYMBOLS

MC	-	MOISTURE CONTENT	LL	-	LIQUID LIMIT
OC	-	ORGANIC CONTENT	PI	-	PLASTISITY INDEX
CN	-	CONSOLIDATION	SW	-	SWELL TEST
DD	-	DRY DENSITY	UU		Unconsolidated Undrained triaxial
PP	-	POCKET PENETROMETER			
RV	-	R-VALUE			
SA	-	SIEVE ANALYSIS			
P200	-	% PASSING #200 SIEVE			

- WATER LEVEL (WITH TIME OF) MEASUREMENT

PLASTICITY CHART



PENETRATION RESISTANCE
(RECORDED AS BLOWS / 0.5 FT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 1	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 3	0.25 - 0.50
MEDIUM DENSE	10 - 30	RATHER SOFT	4 - 5	0.50 - 1.0
DENSE	30 - 50	MEDIUM	6 - 8	
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	
		VERY STIFF	17 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

Chosen Valley Testing, Inc.

Job No. 14202.18.MNR

LEGEND TO SOIL DESCRIPTIONS

CVT

CVT 14202.18.MNR (PRESTON VETERAN'S HOME).GPJ 1/10/19

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BID
PRV AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WI
Project #07985049.2

TABLE OF ARTICLES

Article Number	Article
1	Owner and Bidder
2	Attachments to this Bid
3	Basis of Bid – Lump Sum, and Unit Prices
4	Time of Completion
5	Bidders Acknowledgements: Acceptance Period, Instructions, and Receipt of Addenda
6	Bidder's Representations and Certifications

BID FORM PROVIDED ON QUESTvBID

ONLINE BIDDING ONLY

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ARTICLE 1 - OWNER AND BIDDER

1.01 This Bid is submitted to:

QuestCDN/vBID (www.QuestCDN.com)

Access the electronic bid form by downloading the project documents, and select the online bidding button at the top of the advertisement. Contact Quest at (952) 233-1632 if you have questions on how to upload your bid.

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security _____

B. List of Proposed Subcontractors

_____

_____

_____

C. List of Proposed Suppliers

_____

_____

_____

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualifications Statement with Supporting Data;

ARTICLE 3 - BASIS OF BID – LUMP SUM AND UNIT PRICES

3.01 Unit Price Bids

A. Bidder will perform the following Work at the indicated unit prices:

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ITEM NO.	ITEM DESCRIPTION	EST. QTY	UNITS	UNIT PRICE	TOTAL PRICE
BASE BID					
1	Fixed Costs (mobilization, bonds, insurance, etc.)	1	L.S.	$_____	$_____
2	Booster Station, Complete	1	L.S.	$_____	$_____
3	PRV Station, Complete	1	L.S.	$_____	$_____
ALLOWANCES					
4	Electric Utility Allowance - Booster Station	1	L.S.	$50,0000.00	$50,0000.00
5	Natural Gas Utility Allowance - Booster Station	1	L.S.	$5,000.00	$5,000.00
6	Electric Utility Allowance - PRV Station	1	L.S.	$5,000.00	$5,000.00
	TOTAL: Items #1-#6				$_____

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

BID ALTERNATES

Required Alternate Bid Items are listed below. Owner shall have the right to accept either the Base Bid Items or the corresponding alternate. Failure to supply Alternate Bids may invalidate Bid.

Equipment Listing and Alternate Bid Schedule

A. BID EVALUATION

Bids are to be evaluated on the basis of the base bid manufacturers.

B. BASE BID MANUFACTURERS

It is understood that the total lump sum price above includes only products and equipment of manufacturers specifically named under Column A, Base Bid Manufacturer, within the "Schedule of Equipment Suppliers" shown on Page 00 41 00-X.

The base bid equipment cost shall be listed in Column B for each piece of equipment listed in Column A. This cost shall be for the equipment only and shall include any contractor markup. Where more than one manufacturer is listed under Column A, the Bidder must circle the name of the manufacturer for which a cost is supplied.

C. ALTERNATE MANUFACTURERS

1. Engineer Designated Alternates

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Where one or more ENGINEER Designated Alternates are listed in Column C for an equipment item, the Bidder must fill in Column D indicating the add or deduct from the base bid for each piece of equipment listed in Column C. The add or deduct cost for the equipment shall account for differences in the equipment cost, contractor markup and any additional work to be performed which is not shown on the contract drawings, but which is required as a result of selection of the alternate equipment. If no bid is offered by the Engineer designated equipment manufacturer listed in Column C, the bidder should enter 'no bid' in Column D.

2. Contractor Designated Alternates

Bidders desiring to quote on alternate products; i.e., pieces of equipment not listed under Columns A or C may, at their option, write in a manufacturer's name in Column C and an add or deduct to the base bid in Column D. The add or deduct for the equipment shall account for differences in the equipment cost, contractor markup and any additional work to be performed which is not shown on the drawings, but which is required as a result of selection of the alternate equipment.

SCHEDULE OF EQUIPMENT SUPPLIERS

Document Location	Products and Materials	COLUMN A	COLUMN B	COLUMN C	COLUMN D
Specification Section	Equipment Item	Base Bid Manufacturer	Base Bid Equipment Cost	Alternate Manufacturer	Add or Deduct $ from Base Bid
13 34 30	Fabricated Engineered Structure- Booster Station	USEMCO			
26 90 00	Process Instrumentation and Controls	Telemetry & Process Controls (TPC)		Energenecs	
				IPS	
				Quality Flow	
33 12 33	Prepackaged Above Grade Pressure Reducing Valve	USEMCO			
44 42 00.10	Prefabricated Booster Pump System	USEMCO			

Bidder accepts that Adjustment prices are subject to acceptance by Owner, and rejection of one or more Adjustment prices shall not relinquish acceptance of the Bid.

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ARTICLE 4 - TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.02 Bidder agrees that the Work will be substantially complete on or before September 1, 2027, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before December 31, 2027.

4.03 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5 - BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 Bid Acceptance Period

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 Instructions to Bidders

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 Receipt of Addenda

A. Bidder hereby acknowledges receipt of the following Addenda

Addendum Number	Addendum Date

ARTICLE 6 - BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 Bidder's Representations

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.

2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

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4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 Bidder's Certifications

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

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4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

   a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

   b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

   c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

   d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

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BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

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BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name: **[Full formal name of Bidder]** Address *(principal place of business)*: **[Address of Bidder's principal place of business]**	Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner	**Bid**
Name: **[Full formal name of Owner]** Address *(principal place of business)*: **[Address of Owner's principal place of business]**	Project *(name and location)*: **[Owner project/contract name, and location of the project]** Bid Due Date: **[Enter date bid is due]**
Bond Penal Sum: **[Amount]** Date of Bond: **[Date]**	

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____ *(Full formal name of Bidder)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

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1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
    3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
    3.2. All Bids are rejected by Owner, or
    3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

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NOTICE OF AWARD

Date of Issuance:

Owner: Owner's Contract No.:

Engineer: Engineer's Project No.:

Contract:

Bidder:

Bidder's Address:

You are notified that your Bid dated **[Bid Date]** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for **[Project Name]**

[Describe Work, alternates, or sections of Work awarded.]

The Contract Price of your Contract is $**(Contract Price).** Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

[Number of copies sent] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **[number of copies sent]** counterparts of the Agreement, signed by Bidder (as Contractor).

2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.

3. Other conditions precedent (if any): **[Describe other conditions that require Successful Bidder's compliance]**

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **[OWNER]**_____

By *(signature)*:_____

Name (printed):_____

Title: _____

Copy to Engineer

EJCDC® C-510, Notice of Award.
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AGREEMENT

THIS AGREEMENT is by and between CITY OF NEW RICHMOND ("OWNER") and _____ ("CONTRACTOR").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

OWNER and CONTRACTOR, hereby agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: PRV and Booster Station, City of New Richmond, St. Croix County, WI.

ARTICLE 2 - THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: PRV and Booster Station, City of New Richmond, St. Croix County, WI.

ARTICLE 3 - ENGINEER

3.01 The Owner has retained MSA Professional Services, Inc. ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Engineer.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Contract Times: Dates

A. The Work will be substantially completed on or before June 1, 2027, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before October 5, 2027.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed [and Milestones not achieved] within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

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1. Substantial Completion: Contractor shall pay Owner $1400 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion until the Work is substantially complete.

2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse or fail to complete the remaining Work within the Contract Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay OWNER $900 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, a lump sum of $_____.

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment on the first day of the month in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 Progress Payments; Retainage

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the last day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

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a. 95% of Work completed (with the balance being retainage). If the Work has been 50% completed as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to Owner and ENGINEER, then as long as the character and progress of the Work remain satisfactory to Owner and ENGINEER, there will be no additional retainage; and

b. Estimates may include any fabricated or manufactured materials and components specified, previously paid for by the Contractor and delivered to the work or properly stored and suitable for incorporation in the work embraced in the contract. Invoices showing the amount of the fabricated or manufactured materials and components specified must be submitted with proof of payment by the Contractor prior to being considered for payment. Retainage shall be as outlined in paragraph 6.02.A.1.a. above.

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 97.5% of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 100% of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 Final Payment

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 Consent of Surety

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 Interest

A. All amounts not paid when due will bear interest at the rate of five (5) percent per annum.

ARTICLE 7 - CONTRACT DOCUMENTS

7.01 Contents

A. The Contract Documents consist of all of the following:

1. This Agreement.

2. Bonds:

a. Performance bond (together with power of attorney).

b. Payment bond (together with power of attorney).

3. Contractor's Bid

4. General Conditions.

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5. Supplementary Conditions.

6. Specifications as listed in the table of contents of the project manual (copy of list attached).

7. Drawings (not attached but incorporated by reference) consisting of 57 sheets with each sheet bearing the following general title: PRV and Booster Station.

8. Addenda (numbers _____ to _____, inclusive).

9. Exhibits to this Agreement (enumerated as follows):

   a. N/A

10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

    a. Notice to Proceed.

    b. Work Change Directives.

    c. Change Orders.

    d. Field Orders.

    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8 - REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor's Representations

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

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4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

6. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

7. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

8. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

9. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

10. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 Contractor's Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

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3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 Standard General Conditions

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

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IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____(which is the Effective Date of the Contract).

Owner:	Contractor:
CITY OF NEW RICHMOND *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Name: James Zajkowski *(typed or printed)*	Name: _____ *(typed or printed)*
Title: Mayor *(typed or printed)*	Title: _____ *(typed or printed)*
Date: _____ *(date signed)*	Date: _____ *(date signed)* *(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: Michelle Scanlan, Clerk *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices: 156 East First Street New Richmond, WI 54017	Address for giving notices: _____ _____
Phone: (715) 243-0403	Phone: _____
Email: mscanlan@newrichmondwi.gov *(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	Email: _____ License No.: _____ *(where applicable)* State: _____

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NOTICE TO PROCEED

Owner:	_____	Owner's Project No.:	_____
Engineer:	_____	Engineer's Project No.:	_____
Contractor:	_____	Contractor's Project No.:	_____
Project:	_____		
Contract Name:	_____		
Effective Date of Contract:	_____		

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement: **[Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]**

The date by which Substantial Completion must be achieved is **[date for Substantial Completion, from Agreement]**, and the date by which readiness for final payment must be achieved is **[date for readiness, from Agreement]**.

[or]

The number of days to achieve Substantial Completion is **[number of days, from Agreement]** from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[date, calculated from commencement date above]**; and the number of days to achieve readiness for final payment is **[number of days, from Agreement]** from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[date, calculated from commencement date above]**.

Before starting any Work at the Site, Contractor must comply with the following:

[Note any access limitations, security procedures, or other restrictions]

Owner:	**[Full formal name of Owner]**
By *(signature)*:	_____
Name *(printed)*:	_____
Title:	_____
Date Issued:	_____

Copy: Engineer

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PERFORMANCE BOND

CONTRACTOR (*Name and Address*): Name: [Contractor] Address: [Contractor's Address] [Contractor's City], [Contractor's State] [Contractor's Zip]	SURETY (*Name and Address of Principal Place of Business*): Name: Address:
OWNER (*Name and Address*): Name: [Owner] Mailing Address: [Owner's Address] [Owner's City], [Owner's State] [Owner's Zip]	Contract Description (*Name and Location*): [Project Name] [Owner], [Owner's State] Contract Price: $ [Bid Amount] Effective Date of the Agreement

BOND
Bond Amount : [Bid Amount]
Date of Bond DATE
(Date of bond cannot be earlier than Effective Date of the Agreement):

Modifications to this Bond Form
: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(Full formal name of Contractor)*	_____ *(full formal name of Surety) (Corporate Seal)*
By: _____ *(Signature)*	By: _____ *Signature (attach power of attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title _____	Title _____
Attest: _____ *Signature*	Attest: _____ *Signature*
Name _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

   3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

   3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

   3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

   5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

   5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

   5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

   5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

      5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

      5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the

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payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

   14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

   14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

   14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

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14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

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PAYMENT BOND

CONTRACTOR (*Name and Address*): Name: [Contractor] Address: [Contractor's Address] [Contractor's City], [Contractor's State] [Contractor's Zip]	SURETY (*Name and Address of Principal Place of Business*): Name: Address:
OWNER (*Name and Address*): Name: [Owner] Mailing Address: [Owner's Address] [Owner's City], [Owner's State] [Owner's Zip]	Contract Description (*Name and Location*): [Project Name] [Owner], [Owner's State] Contract Price: $ [Bid Amount] Effective Date of the Agreement

BOND
Bond Amount : [Bid Amount]
Date of Bond DATE
(Date of bond cannot be earlier than Effective Date of the Agreement):

Modifications to this Bond Form
: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(Full formal name of Contractor)*	_____ *(full formal name of Surety) (Corporate Seal)*
By: _____ *(Signature)*	By: _____ *Signature (attach power of attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title _____	Title _____
Attest: _____ *Signature*	Attest: _____ *Signature*
Name _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

   5.1. Claimants who do not have a direct contract with the Contractor

      15..1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

      15..2. have sent a Claim to the Surety (at the address described in Paragraph 13).

   5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

   7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

   7.2. Pay or arrange for payment of any undisputed amounts.

   7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the

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Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1. *Claim*—A written statement by the Claimant including at a minimum:

116..1. The name of the Claimant;

116..2. The name of the person for whom the labor was done, or materials or equipment furnished;

116..3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

116..4. A brief description of the labor, materials, or equipment furnished;

116..5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

116..6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

116..7. The total amount of previous payments received by the Claimant; and

116..8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

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Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price		$ -
2. Net change by Change Orders		$ -
3. Current Contract Price (Line 1 + Line 2)		$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)		$ -
5. Retainage		
a. _____ X $ - Work Completed		$ -
b. _____ X $ - Stored Materials		$ -
c. Total Retainage (Line 5.a + Line 5.b)		$ -
6. Amount eligible to date (Line 4 - Line 5.c)		$ -
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application		$ -
9. Balance to finish, including retainage (Line 3 - Line 4)		$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	
Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

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Progress Estimate - Lump Sum Work **Contractor's Application for Payment**

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: **Application Period:** **From** **to** **Application Date:**

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Original Contract					
			-			-		-
						-		-
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						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Lump Sum Work **Contractor's Application for Payment**

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
Change Orders								
						-		-
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	Change Order Totals	$ -	$ -	$ -	$ -	$ -		$ -
Original Contract and Change Orders								
	Project Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work **Contractor's Application for Payment**

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
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				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Unit Price Work **Contractor's Application for Payment**

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
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					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

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Stored Materials Summary **Contractor's Application for Payment**

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
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								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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FIELD ORDER NO.: [Number of Field Order]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

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WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____ [increase] [decrease] [not yet estimated].

Contract Time: _____ days [increase] [decrease] [not yet estimated].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:		
Date:		

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CHANGE ORDER NO.: [Number of Change Order]

Owner: Owner's Project No.:
Engineer: Engineer's Project No.:
Contractor: Contractor's Project No.:
Project:
Contract Name:
Date Issued: Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	Change in Contract Times [State Contract Times as either a specific date or a number of days]
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. [Number of previous Change Order]: $ _____	[Increase] [Decrease] from previously approved Change Orders No.1 to No. [Number of previous Change Order]: Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	[Increase] [Decrease] this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)	Accepted by Contractor
By: _____	_____
Title: _____	_____
Date: _____	_____
Authorized by Owner	Approved by Funding Agency (if applicable)
By: _____	_____
Title: _____	_____
Date: _____	_____

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:
Engineer:
Contractor:
Project:
Contract Name:

Owner's Project No.:
Engineer's Project No.:
Contractor's Project No.:

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: [Enter date, as determined by Engineer]

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

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{INSERT OWNER NAME }

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Date: _____

Engineer: MSA Professional Services Inc.

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Date: _____

Contractor: {INSERT CONTRACTOR NAME }

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Date: _____

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This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

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Prepared By

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National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

1801 Alexander Bell Drive, Reston, VA 20191-4400

(800) 548-2723

www.asce.org

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STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract

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Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions,

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including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

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32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part

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thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

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4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

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2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

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2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

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3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in

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resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

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ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption,

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and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

   1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

   2. Abnormal weather conditions;

   3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

   4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

   1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

   2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

   3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

   1. The circumstances that form the basis for the requested adjustment;

   2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

   3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

   4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

   5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

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Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b)

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promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

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D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

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C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

    b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

    c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

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F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

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D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

    c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

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5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely

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obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to

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indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

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6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

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H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

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2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

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C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to

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Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

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ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

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B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete

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and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

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3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from the item specified; and

2) available engineering, sales, maintenance, repair, and replacement services.

d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

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B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

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M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

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7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

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2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

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7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

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b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

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B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses,

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damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

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2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay,

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disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

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2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

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9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is

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proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

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10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

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11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract

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Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

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C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

   b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

   c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

   d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

   e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

   f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

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11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

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C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

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D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the

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locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
5. Other costs consisting of the following:
    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not

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be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

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i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish

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and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of

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Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final

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payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

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14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work

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completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress,

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or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

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E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

    b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

    c. Contractor has failed to provide and maintain required bonds or insurance;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

    e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

    f. The Work is defective, requiring correction or replacement;

    g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    h. The Contract Price has been reduced by Change Orders;

    i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

    j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

    k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

    l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

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15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

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F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

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2. The final Application for Payment must be accompanied (except as previously delivered) by:

    a. all documentation called for in the Contract Documents;

    b. consent of the surety, if any, to final payment;

    c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

    d. a list of all duly pending Change Proposals and Claims; and

    e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by

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Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under

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Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take

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possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

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16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

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ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

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18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

No suggested Supplementary Conditions in this Article.

ARTICLE 2 - PRELIMINARY MATTERS

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. Owner shall furnish to Contractor 2 printed copies of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 Electronic Transmittals

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol (“EDP” or “Protocol”) for exchange of electronic transmittals.

1. *Basic Requirements*

a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.

b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

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d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 20 MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by

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physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

h. The Owner will operate a Project information management system (also referred to in this EDP as “Project Website”) for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:

    1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;

    2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;

    3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and

    4) Include any other Project Website attributes that may be pertinent to Contractor’s use of the facility and pricing of such use.

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C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

   a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	

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a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	

Notes	
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.
Key	
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version 1.6 or later
DWG	Autodesk® AutoCAD .dwg format Version 2018.
DOC	Microsoft® Word .doc or .docx format Version 365.
EXC	Microsoft® Excel .xls, .xlsx or .xml format Version 365.
DB	Microsoft® Access .mdb format Version 365.

ARTICLE 3 - DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

SC-3.01 Delete Paragraph 3.01.C. in its entirety.

ARTICLE 5 - SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 Subsurface and Physical Conditions

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
none		[Identify Technical Data]

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the

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Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
none		[Identify Technical Data]

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

B. Not Used.

ARTICLE 6 - BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2018 edition).

6.03 Contractor's Insurance

SC-6.03 Add the following new paragraph immediately after Paragraph 603.C:

D. Other Additional Insureds: As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, and pollution liability policies must include as additional insureds (in addition to Owner and Engineer) the following:

1. CITY OF NEW RICHMOND

2. MSA Professional Services, Inc.

E. Workers' Compensation and Employer's Liability: Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

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Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Bodily injury by accident—each accident	$100,000
Bodily injury by disease—Each Employee	$100,000
Bodily Injury by Disease – Policy Limit	$500,000

F. Commercial General Liability—Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,

2. damages insured by reasonably available personal injury liability coverage, and

3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.

   a. Such insurance must be maintained for three years after final payment.

   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Severability of interests and no insured-versus-insured or cross-liability exclusions.

4. Underground, explosion, and collapse coverage.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not

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commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content*: The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of Contractor's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	

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Automobile Liability	Policy limits of not less than:
Property Damage	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$5,000,000
General Aggregate	$5,000,000

L. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$1,000,000
General Aggregate	$1,000,000

☐ If box is checked, Contractor is not required to provide Contractor's Pollution Liability Insurance under this contract.

M. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000
Annual Aggregate	$1,000,000

P.

6.04 Builder's Risk and Other Property Insurance

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SC-6.04 Delete Paragraph 6.04.A of the General Conditions and substitute the following in its place:

A. *Installation Floater*

1. Contractor shall provide and maintain installation floater insurance on a broad form or "all risk" policy providing coverage for materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work ("Covered Property"). Coverage under the Contractor's installation floater will include loss from covered "all risk" causes (perils) to Covered Property:

    a. of the Contractor, and Covered Property of others that is in Contractor's care, custody, and control;

    b. while in transit to the Site, including while at temporary storage sites;

    c. while at the Site awaiting and during installation, erection, and testing;

    d. continuing at least until the installation or erection of the Covered Property is completed, and the Work into which it is incorporated is accepted by Owner.

2. The installation floater coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable.

3. The installation floater coverage will be in an amount sufficient to protect Contractor's interest in the Covered Property. The Contractor will be solely responsible for any deductible carried under this coverage.

4. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

7.02 Supervision and Superintendence

SC-7.02 Add the following paragraphs immediately after Paragraph 7.02.B.

7.02.C. Character of Workers

(1) Provide personnel necessary to supervise and complete all contract work as specified. Ensure workers have the experience and skills necessary to perform assigned work.

(2) Contractor will address non-compliance with Conduct expectations (paragraph 7.20(A)) and will take all reasonable action as is necessary to prevent and correct violations of the Conduct expectations, including and up to removal of workers from assigned work.

7.03 Labor; Working Hours

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SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.

7.10 Taxes

SC 7.10 Add a new paragraph immediately after Paragraph 7.10.A:

B. Owner represents that it is a qualifying exempt entity under section 77.54(9m), Wis. Stats. (as created by 2015 Wis. Act 126) with respect to exemption from Wisconsin sales and use tax of certain items that become part of eligible facilities owned by the qualifying exempt entity. The contract price accounts for such sales and use tax exemptions, to the extent applicable. Contractor shall not be entitled to an increase in contract price if Contractor is not successful in obtaining an anticipated sales and use tax exemption, unless the reason for the inability to obtain the anticipated exemption is a formal determination by the State of Wisconsin that Owner is not a qualifying exempt entity.

1. OWNER's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by CONTRACTOR, or to supplies or materials not incorporated into the Work.

7.20 Conduct Expectations

SC-7.20 Add the following immediately following Paragraph 7.19 of the General Conditions.

7.20 Conduct Expectations

A. Contractor understands their obligations to provide a safe, respectful work environment for their employees, for the Owner's employees, for the Engineer's employees and the general public. The Contractor agrees that harassment on the job (unwelcome verbal, physical or other behavior that is related to sex, race, age, or protected class status) will not be tolerated and will be addressed timely and in compliance with anti-harassment laws.

ARTICLE 9 - OWNER'S RESPONSIBILITIES

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.03 Project Representative

SC-10.03 Add the following new subparagraph immediately after Paragraph 10.03.A:

1. On this Project, by agreement with the Owner, the Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

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SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

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7. *Completion*

   a. Participate in Engineer's visits regarding Substantial Completion.

   b. Assist in the preparation of a punch list of items to be completed or corrected.

   c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

   d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

10.09 Character of Work

SC-10.09 Add the following new paragraph immediately after Paragraph 10.08 of the General Conditions:

10.09 Character of Workers

A. The Engineer may suspend the work in writing, withhold progress payments due the contractor, or both for the following reasons:

(1) The Contractor does not furnish suitable and sufficient personnel to perform the work.

(2) The Contractor fails to take sufficient actions to prevent and correct violations of the Conduct expectations (paragraph 7.20(A)), including and up to removal of workers from assigned work.

10.10 Conduct Expectations

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SC-10.10 Add the following new paragraph immediately after Paragraph 10.09 of the General Conditions:

10.11 Conduct Expectations

A. Engineer understands their obligations to provide a safe, respectful work environment for their employees, for the Contractor's employees, for the Owner's employees and the general public. The Engineer agrees that harassment on the job (unwelcome verbal, physical or other behavior that is related to sex, race, age, or protected class status) will not be tolerated and will be addressed timely and in compliance with anti-harassment laws.

ARTICLE 11—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 13—ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.03 Unit Price Work

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

    a. the extended price of a particular item of Unit Price Work amounts to 10 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

    b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

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ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

SC-15.01 Add the following new Paragraph 15.01.F:

F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

15.03 Substantial Completion

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

Add the following after 17.01

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration

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Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

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4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].

17.03 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Pressure Reducing Valve Station (Structure 20)

1. The work under this contract includes the construction of a factory designed and assembled, above ground pressure reducing valve station located at the intersection of County Highway K and Fox Way in New Richmond, Wisconsin. The work under this contract includes all materials and labor required to furnish and install a completely operable pressure reducing valve station with all appurtenances, including, but not limited to, internal valves, piping, electrical controls and accessories.
2. The work under this contract includes the excavation, installation and backfill of the pressure reducing valve station's precast foundation slab.
3. The site work under this contract includes site grading, installation of connecting Primary and North East Zone(s) water mains to the pressure reducing valve station, a driveway and parking area to access the station including aggregate base course and asphaltic pavement, concrete pavement working space, erosion control, and turf restoration.
4. The work under this contract includes coordination with New Richmond Utilities for the installation of a single phase electric service to the station.
5. The work under this contract shall include system integration to incorporate the new pressure reducing valve station into the City's existing supervisory control and data acquisition (SCADA) system.

B. North Booster Station (Structure 30)

1. The work under this contract includes the construction of a factory designed and assembled, water process booster and control valve system at the intersection of Brady Lane and North Shore Drive in New Richmond, Wisconsin. The work under this contract includes all materials and labor required to furnish and install a completely operable booster station with all appurtenances, including, but not limited to, cast-in-place concrete foundation, prefabricated station structure, plumbing systems, booster pumps, internal valves, piping, pressure control valve, electrical controls and accessories.
2. The work under this contract includes the structural excavation and backfill of the booster station foundation.
3. The site work under this contract includes site grading, installation of connecting suction and discharge water mains to the booster station, a driveway to access the booster station including aggregate base course and asphaltic pavement, erosion control, and concrete and soils testing.
4. The work under this contract includes coordination with New Richmond Utilities for the installation of a three phase electric service to the booster station.
5. The work under this contract shall include system integration to incorporate the new booster into the City's existing supervisory control and data acquisition (SCADA) system.

PART 2 PRODUCTS AND MATERIALS (NONE)

PART 3 EXECUTION (NONE)

END OF SECTION

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SECTION 01 14 00
WORK RESTRICTIONS AND PROVISIONS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, current edition.
   2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK (N/A)

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (N/A)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (N/A)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 EXAMINATIONS

A. Contractor shall obtain complete data at the site and inspect surfaces that are to receive the work before proceeding with assembling, fitting or erecting his work under this contract. The Contractor shall notify the Engineer in writing in the case of discrepancies between existing work and drawings, and of any defects in surfaces that are to receive the Contractor's work. The Engineer will direct the remedy of applicable surfaces.

B. Information pertaining to existing conditions that appear on the drawings is based on available records. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing or that unexpected developments may not occur. All data included was provided to assist the Contractor in the investigation of conditions. The Contractor is responsible for the interpretation of the data provided.

C. The Contractor shall become acquainted with the location of underground service, utilities, structures, etc., which may be encountered or be affected by the Contractor's work, and shall be responsible for any damage caused by neglect to provide proper precautions or protection.

D. Utility Locations. Contractor shall be responsible for locating and verifying all utilities on the project and also all relocations where necessary. Typically, the utilities require the request for locate be made a minimum of three working days before the Contractor begins work in the area. The utilities shown on the contract drawings are approximate in location, depth, number, and type.

E. Contractor shall verify grades, lines, levels, locations, and dimensions as shown on drawings and report any errors or inconsistencies to the Engineer before commencing work. Starting of work by the Contractor shall imply acceptance of existing conditions.

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3.02 STORAGE AND HANDLING

A. Contractor or the Contractor's authorized representative must be present to accept delivery of all equipment and material shipments. The Owner's employees will not knowingly accept, unload, or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by any representative of the Owner shall not constitute acceptance or responsibility to assume all liability for any equipment or material delivered to the job site.

B. Any material or equipment removed from the present construction shall be the property of the Owner and disposition shall be as directed by the Owner or stockpiled at locations shown on the contract drawings. All salvaged materials shall be removed in a workmanlike manner and carefully transported to Owner's storage area. The Contractor shall coordinate the salvaging of items with the Owner.

C. Contractor shall confine all operations, equipment, apparatus, and storage of materials to the immediate area of work to the greatest possible extent. Contractor shall ascertain, observe, and comply with all rules and regulations in effect on the project site, including, but not limited to parking and traffic regulations, use of walks, security restrictions and hours of allowable ingress and egress.

D. The storage of materials on the grounds shall be in strict accordance with the instructions of the Owner.
   1. All materials affected by moisture shall be stored on platforms and protected from the weather in accordance with manufacturer recommendations.
   2. Should it be necessary at any time to move material storage platforms, the Contractors shall move same at the Contractor's expense, when directed by the Owner.
   3. Areas used for storage of materials shall be repaired and restored by the Contractor.

E. The Owner assumes no responsibility for materials stored on the site. The Contractor shall assume full responsibility for damage due to the storage of materials.

F. During the construction of this project, materials, storage areas, and earth stockpiles shall be located so as not to interfere with the installation of the utilities nor cause damage to existing structures or utilities.

3.03 WORK RESTRICTIONS AND PROVISIONS

A. Notification. The Contractor shall notify the Owner and the Engineer 72 hours in advance of beginning work. Notice must also be given to the Owner and the Engineer for each subsequent day the Contractor will be working.

B. Operation During Construction. The existing facilities shall remain completely operational during construction. The Contractor shall be responsible to see that the facilities are operating as they should. Sequence of operations or place of commencement may be determined by the Engineer as deemed to best serve the needs and convenience of the Owner, or as necessity of occasion requires.

C. Starting of work implies acceptance of the work of others. Removal and replacement of work applied to defective surfaces, in order to correct defects, shall be done at the expense of the Contractor who applied work to defective surfaces.

D. Access to Work. Representatives of the State and Federal Regulatory Agencies and Owner shall have access to the work and on-site records at all times.

E. Project Log. A project log shall be maintained showing daily progress of work. Engineer and Owner shall have access to this logbook and the project schedule at all times.

F. Existing pipes, electrical work, and all other utilities encountered, which may interfere with new work, shall be rerouted, capped, cut off, or replaced by the Contractor.

G. Dust and Noise. Contractor shall make an effort to keep dust and noise to a minimum during construction. The dispersion of dust from construction related activities shall, until acceptance of work, be minimized by the application of water or other acceptable materials or covers. Noise from any construction activities

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shall only be allowed during approved working hours. This includes preparation, organizational and clean-up work. Work hours are limited to weekdays between 7 a.m. and 7 p.m. unless specifically stated elsewhere in these specifications or approved during construction by the Owner and Engineer in writing. Only maintenance of traffic and/or erosion control activities are allowed outside of these times.

H. Contractor shall confine equipment, apparatus, storage of materials and operations to limits by specific direction of the Owner or Engineer and shall not bring material onto the site until they are needed for the progress of the work.

I. Cleaning. Contractor shall be responsible for all cleaning required within the technical sections of the specifications governing work under the Contractor's jurisdiction as well as for keeping all work areas, passageways, and all other areas of the premises free of rubbish, debris and scrap which may be caused by the Contractor's operations or that of the Subcontractors.

1. Remove rubbish, debris, and scrap promptly upon its accumulation and in no event later than the end of each week.
2. Combustible waste shall be removed immediately or stored in fire resistive containers until disposed of in an approved manner.
3. Spillage of oil, grease, or other liquids which could cause a slippery or otherwise hazardous situation or stain a finished surface, shall be cleaned up immediately.
4. Dust, dirt, and other foreign matter shall be removed completely from all internal surfaces of all mechanical and electrical units, cabinets, ducts, pipes, etc.
5. Dirt, soil, fingerprints, stains and the like, shall be completely removed from all exposed finished surfaces.
6. If rubbish and debris is not removed, or surfaces cleaned as specified above, the Owner reserves the right to have said work done by others and the related cost(s) will be deducted from monies due the Contractor.

J. Disposal of Demolished Materials. Remove from the site all debris, rubbish, and other materials resulting from demolition operations. Storage of removed materials will not be permitted on the site. If burning is allowed, the Contractor shall obtain all required permits.

K. Mail Service.

1. Temporary relocation of mailboxes. If the Postal Carrier cannot deliver mail to the properties affected by the construction of utilities or roadway, the Contractor shall provide temporary mailboxes or shall relocate existing mailboxes to an accessible site. Contractor shall relocate mailboxes to their new location and set to proper height, as directed by an authorized representative of the US Postal Service. Mailboxes shall be reset as close to original location as possible, unless otherwise noted, while maintaining proper height and location requirements of the US Postal Service, upon restoration of regular postal service. If mailboxes, bases or posts are damaged during removal, it shall be the Contractor's responsibility to replace the damaged part prior to reinstallation. Contractor shall not be responsible for correction of existing deficient mailboxes, bases, or posts. Owner and Engineer shall be notified of such instances immediately.
2. Final relocation of mailboxes. If the Postal Carrier can deliver mail to affected properties during construction, Contractor shall maintain reasonable access to said mailboxes. Upon completion of the project, Contractor shall relocate mailboxes to a location and height that meets the US Postal Service requirements along affected roadways.

L. Street Signs. The Contractor shall salvage and reinstall all signs affected by construction. All signs to be removed shall be done in a workmanlike manner and carefully transported to Owner's storage area. If signs, sign bases or posts are damaged during removal, it shall be the Contractor's responsibility to replace said sign, base or post prior to reinstallation.

M. Garbage Collection. Garbage and/or recycling collection will continue throughout the project. Contractor shall provide temporary access to garbage vehicles throughout the project area or assist with garbage collection in areas inaccessible to vehicular traffic during the project.

3.04 OPERATION AND PROTECTION

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A. Contractor shall schedule his work as to minimize the inconvenience to the Owner and residents adjacent to the project.

B. Traffic Control. The Contractor shall meet the requirements for traffic control in accordance with the Manual on Uniform Traffic Control Devices. All structures and equipment shall be constructed, installed, and operated with guards, controls, and other devices in place.

C. The Contractor shall provide protection as follows:

1. Protection. The Contractor shall provide and maintain proper barricades, fences, signal lights, or watchmen to properly protect the work, persons, animal and property against injury. The cost of protection shall be incidental to the contract and no extra payment will be allowed therefore.
2. Provide, erect, and maintain all required barricades, guard rails, temporary walkways, etc., of sufficient size and strength necessary for protection of stored material and equipment; adjacent to or within project area; adjoining property and the building(s) as well as to prevent accidents to the public and the workmen at the job site.
3. Provide and maintain proper shoring and bracing for existing underground utilities encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the new work, or can be properly backfilled upon completion of new work.
4. Provide protection against rain, snow, wind, ice, storms or heat so as to maintain all work, materials, apparatus, and fixtures, incorporated in the work or stored on the site, free from injury or damage. At the end of the day's work, cover all new work likely to be damaged. Remove snow and ice as necessary for safety and proper execution of the work.
5. Protect the building and foundations from damage at all times from rain and groundwater. Provide all equipment and enclosures as necessary to provide this protection.
6. Damaged property shall be repaired or replaced in order to return it to preconstruction conditions.
7. Protect materials, work, and equipment, not normally covered by above protection, until construction proceeds to a point where the general building protection of the area where located, dispenses with the necessity therefore. Protect work outside of the building lines such as trenches and open excavations, as specified above.
8. Take any and all necessary precautions to protect Owner's property as well as adjacent property, including trees, shrubs, buildings, sanitary sewers, water piping, gas piping, electric conduit or cable, etc., from any and all damage which may result due to work on this project.
9. Repair work outside of property line in accordance with the requirements of the authority having jurisdiction.
10. Repair any work damaged by failure to provide proper and adequate protection to its original state to the satisfaction of the Owner or remove and replace with new work at the Contractor's expense.
11. Tree Protection. Trees shall be protected from damage and scarring. Do not injure trunks, branches, or roots of trees that are to remain. No trees shall be removed without the approval of the Owner. Tree branches in the way of construction operations shall be carefully pruned prior to construction. Do cutting and trimming only as approved and as directed by the Owner. Do not operate equipment or vehicles within the drip line of a tree to be preserved. Any roots exposed during construction shall be cut clean. Ripping of the roots with excavation equipment shall not be allowed.
12. All survey monuments, property stakes, etc., which are encountered during the construction are to be preserved and undisturbed. The Engineer shall be notified of all such items immediately upon discovery. Failure to preserve such monuments will not be allowed and replacement shall be at the Contractor's expense.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Work restrictions and provisions shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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4.02 WORK RESTRICTIONS AND PROVISIONS

A. Work Restrictions and Provisions, Inclusive. The cost associated with work restrictions and provisions shall be considered inclusive to payment for work related to the associated construction item, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. To provide adequate budget and bonding to cover items not precisely determined prior to bidding, include in the Contract Price the costs or quantities described in this Section.

B. Adjustment of Cost:
1. If cost or quantity is more or less than the specified allowance, Contract Price will be adjusted by Change Order, unless stated otherwise herein.
2. Submit documentation for engineer review for the actual costs or quantities after completion of Work. Documentation shall include actual invoices or billing statements and evidence of payment.

C. Designate in schedule of values costs and quantities required under each allowance.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.07 SPECIFIC ALLOWANCES

A. Electric Service – Pressure Reducing Valve Station
1. The Contractor shall coordinate new electric services. For bidding purposes, the Contractor shall include $5,000 in his bid for electric service. This cost shall cover installation/upgrade of new electric service to the site.

B. Electric Service – North Booster Station
1. The Contractor shall coordinate new electric services. For bidding purposes, the Contractor shall include $50,000 in his bid for electric service. This cost shall cover installation/upgrade of new electric service to the site.

C. Natural Gas Service – North Booster Station
1. The Contractor shall coordinate new natural gas service. For bidding purposes, the Contractor shall include $5,000 in his bid for natural gas service. This cost shall cover installation/upgrade of new natural gas service.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 01 29 73
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 1 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Provide a detailed breakdown of the Contract Price showing amounts and quantities allocated to each of the various parts of the Work, as specified herein and as required by General Conditions.

B. Upon request of Engineer, support amounts and quantities with data substantiating their correctness.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.07 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule shall be typed on 8-1/2-inch by 11-inch white paper. Contractor's standard forms and automated printout will be considered for approval by Engineer upon request. Include following:
1. Project title.
2. Project location.
3. Owner.
4. Engineer.
5. Engineer's project number.
6. Name and address of Contractor.
7. Contract designation.
8. Date.

B. Identify installed value of Work in sufficient detail to serve as basis for computing values for progress payments during construction.

C. Provide a separate listing of general items, such as bonds, insurance, mobilization, field supervision, construction facilities, allowances, and record documents.

D. Follow Project Manual table of contents as format for listing component items. At a minimum, listing shall include material cost and total installed cost for each Specification Section for each structure as listed in this Section.
1. Identify each line item with number and title of respective Specification Division and Section.
2. Include directly proportional amount of Contractor's overhead and profit.
3. For items on which progress payments will be requested for stored materials, break down value into:
   a. Cost of materials, delivered and unloaded.
   b. Total installed value.

E. Provide listing of items for each specification section of sitework and for each specification section of structure related construction, each specifications section of piping work, each specification section of process equipment, each specifications section of electrical and instrumentation work. Each item of work

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shall breakdown costs for materials, labor, and installation. General project cost items shall include breakdown of testing, mobilization/demobilization, bonds, insurance, and Contractor's project administration.

F. Sum of values listed shall equal total Contract Price.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 01 31 13
PROJECT COORDINATION

GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The General Contractor or his appointed representative shall act as the project coordinator. He shall generally be charged with all duties of a project coordinator including, but not limited to, being responsible for conditions of the contract, administrative requirements, subcontractor's scheduling and cooperation, compliance with specifications and drawings, and all other work related requirements.

B. Contractor shall coordinate the work with adjacent work and shall cooperate with all other Contractors so as to facilitate the general progress of the work. Each Contractor shall afford all other Contractors every reasonable opportunity for the installation of their work and for the storage of their material. In no case will any Contractor be permitted to exclude from the premises or work, any other Contractor or employees thereof, or interfere with any Contractor in the executing or installation of the work.

C. Each Contractor shall perform its work in proper sequence in relation to that of other Contractors and as approved by the Engineer. Any cost caused by defective or ill-timed work shall be borne by the Contractors responsible therefore.

D. Contractor shall arrange the work and dispose of materials so as not to interfere with the work or storage of materials of others and each shall join their work to that of others in accordance with the intent of the drawings and specifications.

E. All Contractors shall work in cooperation with each other and fit their work into the structure as job conditions may demand. All final decisions as to right-of-way and run of pipes and ducts, etc., shall be made by the Engineer or the Owner.

F. It shall be the responsibility of the Contractor to keep constant check on the progress of the work so that each particular trade can insure proper preparation for installation of that Contractor's work and not cause delay in the progress of the work. It shall further be the responsibility of the Contractor to periodically make inspections of work in progress and to notify the Engineer when work is complete in compliance with specifications and drawings.

G. A project log shall be maintained showing daily progress of work. The Engineer and Owner shall have access to this log book and the project schedule at all times.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

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PART 4 MEASUREMENT AND PAYMENT (N/A)

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SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Preconstruction Meeting. A Preconstruction Meeting will be scheduled and conducted by the Engineer and shall be attended by representatives of the Owner, Contractor and all subcontractors as deemed required by the Engineer. The purpose of the meeting will be to identify all project participants, review project requirements and specifications, establish the method of making pay requests and other matters that may be deemed necessary to be discussed. At this meeting, the Contractor shall submit the proposed construction schedule for review, consensus by the parties and approval. The Contractor shall also submit a schedule of values for the work to be used as the accounting format for all progress payments.

B. Construction Progress Meetings. Brief weekly meetings, as deemed necessary by the Engineer, will be held and shall be attended by all Contractors. The purpose of the meeting will be to coordinate work schedules, review the project progress and other matters that may be deemed necessary to be discussed.

1. A construction progress meeting agenda shall be prepared as deemed necessary to the Engineer.
2. All construction progress meeting attendees shall be fully prepared prior to the meeting and shall be ready to discuss issues raised as they relate to their work. This shall include, but not be limited to, providing revised schedules, milestone activities, specific requirements for subordinate construction and any proposed or completed changes required for their work.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Submit preliminary Construction Progress Schedule in accordance with General Conditions prior to pre-construction conference.

B. The Contractor shall comply with and the Work shall be completed in accordance with the following construction schedule:
   1. Award Contract (January 12, 2026 - Tentative)
   2. Notice to Proceed (February 2026 – Tentative)
   3. Substantial Completion. Substantial completion shall be completed by September 1, 2027. Substantial completion shall include all work completed on the project to allow the PRV and booster station to be put into service.
   4. Final Completion. The project shall be completed by December 31, 2027. Final Completion shall include all work as shown on the Contract Drawings and detailed in these specifications and all items addressed in final project closeout punchlist.
   5. Within 30 days of final completion, submit final project closeout documentation inclusive of lien waivers, affidavit of compliance with prevailing wage rate determination, and final pay request.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS

A. Furnish four (4) copies of preliminary schedule, and subsequent revisions thereof, to Engineer three (3) days before each progress meeting.

B. Within three (3) days after monthly progress meetings, furnish four (4) copies of revised schedule to Engineer. Furnish revised schedule to Subcontractors as appropriate.

C. Failure to submit schedules on a timely basis shall be considered cause for withholding progress payments.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 FORM OF SCHEDULE

A. Prepare schedule in form of horizontal bar chart.
   1. Provide separate horizontal bar for each trade, activity or operation.
   2. Provide continuous vertical line to identify first working day of each week.
   3. Scale and space to allow for notations and future revisions.

3.02 CONTENT OF SCHEDULE

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A. Show complete sequence of construction by activity or operation.

B. Show dates for beginning and completion of each major element of construction and installation dates for major equipment items. Include:
   1. Each individual task of construction.
   2. Procurement of equipment and systems including Shop Drawing submittals, Engineer's review of submittals, shop tests, and delivery dates.
   3. Identification of Work that will affect existing plant operations.
   4. Services of manufactures' representatives.
   5. Startup dates for major equipment.
   6. Field tests.
   7. Dates of Substantial and Final completion.
   8. Subcontractor Work items.
   9. MBE, WBE, and SBE activities.
   10. O&M data activities
   11. Contractor-provided training.

C. Show projected percentage of completion for each activity as of first day of each month.

3.03 REVISIONS TO SCHEDULE

A. Each month Contractor shall receive update information from Subcontractors and Suppliers that shall be included in current schedule. Revised schedule shall indicate changes such as:
   1. Major changes in scope.
   2. Activities modified since previous submittal.
   3. Revised projections of progress and completion.
   4. Other identifiable changes.

B. Provide narrative report to define following:
   1. Problem area and anticipated delays and their impact on schedule.
   2. Corrective action recommended and its effect.

3.04 MONTHLY PROGRESS MEETINGS

A. Once each month Construction Progress Schedule will be reviewed. Progress will be reviewed:
   1. To identify those activities started and completed during previous period.
   2. For remaining duration required to complete each activity started, but not completed.
   3. For durations of selected activities not yet started.
   4. For effect of Change Orders and proposed sequencing.

B. Update schedule accordingly.

3.05 DELAYS AND RECOVERY

A. If, at any time during the Project, Contractor fails to complete activity by its latest scheduled completion date, Contractor shall, within five (5) working days, submit to Engineer written statement as to how and when work force will be reorganized to return to current construction schedule.

B. If, during schedule review meetings, it becomes apparent that milestone completion dates or Contract completion dates will not be met, Contractor shall take some or all of the following actions:
   1. Increase construction staffing in such quantities and crafts as shall eliminate backlog of Work.
   2. Increase number of working hours per shift, shifts per day, Work days per week, amount of construction equipment or combination of foregoing sufficient to substantially eliminate backlog of Work.
   3. Reschedule Work actives to achieve concurrency of accomplishment

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C. Under no circumstances will addition of equipment or construction forces, increasing working hours or other method, manner or procedure to return to current Construction Progress Schedule be considered justification for Contract modification or treated as acceleration.

PART 4 MEASUREMENT AND PAYMENT

4.01 CONSTRUCTION PROGRESS SCHEDULE

A. General. Construction Progress Schedule shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Construction Progress Schedule, Lump Sum. When so provided, payment for construction progress schedule shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Construction Progress Schedule, Inclusive. When no quantity is provided, construction progress schedule shall be considered inclusive to payment for work associated with administration.

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SECTION 01 32 23
SURVEY AND LAYOUT DATA

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 1 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The Contractor will stake and layout all work. The Contractor shall immediately, upon entering the site for purpose of beginning work, locate general reference points and take such action as necessary to prevent their destruction. The Contractor shall layout the work and be responsible for all lines, elevations and measurements. The Contractor must exercise proper precaution to verify dimensions of the drawings before laying out work and will be held responsible for any error resulting from failure to exercise such precaution.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS

A. Automated Machine Guidance (AMG) Control / Staking Plan

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 CONSTRUCTION SURVEY LAYOUT REQUIREMENTS AND TOLERANCES

A. Tolerances for staking shall be 0.02 feet horizontal and 0.01 feet vertical unless otherwise stated.

Construction Staking Tolerances

Item	Horizontal	Vertical
Slope Stakes	0.25 feet	0.10 feet
Structure Layout	0.02 feet	0.01 feet
Sanitary Sewer	0.02 feet	0.01 feet
Water Main	0.10 feet	0.03 feet
Storm Sewer	0.02 feet	0.01 feet
Pipe Culverts	0.25 feet	0.03 feet
Electrical	0.02 feet	0.01 feet
Subgrade	0.25 feet	0.10 feet
Base Aggregate	0.25 feet	0.04 feet
Curb and Gutter	0.02 feet	0.01 feet
Curb Ramps	0.02 feet	0.01 feet
Concrete Pavement	0.02 feet	0.01 feet

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SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing submittal information as required by the contract drawings, other specification sections and as specified herein.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittal Log - Section 01 33 23

1.05 SUBMITTALS

A. As soon as possible after Notice to Proceed, submit brochures of catalog cuts and specifications for all new equipment. Submittal of product data shall comply with the requirements for Submittals.

B. Prior to fabrication or installation, submit Submittals for review. Each submittal shall consist of the minimum number of copies as listed on the submittal log. Two will be returned to the Contractor. Should more than two copies of reviewed Submittals be necessary for Contractor's use and distribution, the Contractor shall supply additional sufficient number of Submittals for review as required.

C. Submittals shall include layout details, schedules, setting instructions, and manufacturer's literature. Concrete reinforcing steel Submittals shall include a concrete pouring sequence for structures with vertical construction joints.

1. Submittals shall be identified with the name of the project, numbered consecutively and bear the stamp of review of the Contractor as evidence that all drawings have been checked by the Contractor for accuracy and compatibility with contract requirements. Drawings not so checked and noted will be returned without being examined.
2. Partial lists will not be considered; Submittals for each part of work shall be complete in one submittal.

D. If information on previously submitted Submittals is altered, in addition to the notations made by the Engineer, the Contractor shall bring all changes to the attention of the Engineer. Corrections or changes indicated on reviewed Submittals shall not be considered an order for extra work.

E. Submittals will not be considered reviewed unless they bear the stamp of review and signature of the Engineer. Drawings will be reviewed for general design only. Dimensions and fit of units of various parts shall be the Contractor's responsibility.

F. Prior to work at the site, submit samples allowing reasonable time for review and testing. Submit samples in sufficient quantity (minimum of five), of adequate size showing quality, type, color range, finish and texture. Label each sample stating material, description, applicable specification sections, intended use, project name, and Contractor's name.

G. Order no materials subject to sample review until receipt of written shop drawing review. Materials installed shall match reviewed samples. No review of samples shall be taken in itself to change or modify contract requirements beyond the expressed stipulations of the review letter.

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H. All Submittals for major equipment must be reviewed and delivery dates scheduled prior to performing any work at the site. A revised work schedule shall be submitted weekly showing corrected delivery dates.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Prior to start up of the equipment, the Contractor shall provide the Engineer with operation and maintenance manuals as listed on the submittal log. The manuals shall include the following:

1. Supplier and manufacturer's name, address, telephone number, and local representative's name, address and telephone number. Sources of service and parts and a list of local repair services, supply houses, and potential sources for the types of repairs and equipment parts.
2. Complete and accurate set of record drawings including drawing dimensions, schematics of hydraulics, wiring, and piping.
3. Warranties and bonds shall be included in manual.
4. Catalog literature complete with test data and performance data and ratings.
5. Specify equipment function, normal operating, and limiting conditions.
6. Assembly, installation, alignment, adjusting, and checking instructions.
7. Operating instructions for start-up, shutdown, routine and normal operation.
8. Emergency operating instructions indicating range and flexibility during emergencies.
9. Detailed service information including schedule of recommended maintenance.
10. Troubleshooting, common operating problems, problems that might occur in unit/process. List probable causes and discuss control/prevention.
11. Detailed safety section covering the operation and maintenance of unit. Contractor shall supply a complete list of equipment service numbers, model numbers, electrical requirements, manufacturer's names, etc.
12. The correct model number shall be designated where the literature covers more than one model.
13. For items assembled by the Contractor, the Contractor shall write and provide duplicate operation and maintenance instructions.
14. Data shall be folded to 8-1/2 inch x 11 inch size and placed into hard cover binders. Material shall be grouped according to specifications section and filed behind individual filing tab pages on which the following is to be typed: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, Manufacturer's Order Number.
15. Manuals shall be delivered to the Engineer for approval prior to job completion.

1.07 PERMITS AND APPROVALS

A. Obtain and submit copies of all permits, code inspections, and approval documents, as specified.

1.08 CONSTRUCTION SCHEDULE

A. Submit a minimum of five copies of a schedule of operation prior to construction. The schedule shall provide for activities of the various trades and shall be sequenced to provide a minimum of interruption to the operation of existing facilities. Allow ample time for the Owner to alter operations as required by the construction of the various components of the work. Revised and updated construction schedule shall be provided throughout the construction as deemed necessary and requested by the Engineer.

B. The construction schedule shall be supplemented by a list of Submittals, dates they will be submitted for approval and a reasonable time allowance for review.

1.09 START-UP REPORTS

A. Where equipment startup by a factory-trained representative is required, a minimum of three copies of the start-up report shall be submitted which describe the representatives activities and installation approval.

1. Start-up report shall be a typewritten document containing descriptive information specifically identifying the piece by equipment, all tests conducted, and the results of the tests.
2. Start-up role log, with the dated signatures of those conducting and accepting all start-up instructions and tests shall be provided as part of the report.

B. Substantial completion will not be issued until all start-up reports have been submitted.

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1.10 RECORD DRAWINGS

A. The Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.

1. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
2. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner.

1.11 SUBMITTAL LOG

A. A submittal log is included as Section 01 33 23 of this Project Manual, which lists the minimum required Submittals, product data, samples, and operation and maintenance manuals. Additional submittals not listed on the log may be required by the Engineer during the course of construction. All submittals to the Engineer shall include the submittal number shown on the log. The minimum number of copies to be submitted is shown on the submittal log. Any additional copies required by the Contractor may be submitted in addition to the number shown on the log.

B. Submit a minimum of five (5) copies of the American Iron and Steel (AIS) checklist a minimum of one week prior to the pre-construction meeting. The AIS checklist shall provide a list of all products and materials to be furnished to complete the project. ENGINEER may review and request the CONTRACTOR to provide additional statements/certifications for any products and materials provided on the project.

C. Revised and updated AIS Checklist shall be provided with all pay requests. Certification or statements of AIS compliance shall be provided with payment requests for all AIS products and materials.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Submittals shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 SUBMITTALS

A. Submittals, Inclusive. The cost for all submittals shall be considered inclusive to payment for work related to the respective equipment, associated construction, or utility, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES SUBMITTAL LOG

PROJECT: PRV and Booster Station
CITY OF NEW RICHMOND

MSA PROJECT NO: 07985049.2

CONTRACTOR:

Spec Section #	Spec Section Title/Product	Date Rec'd	Min. # Req'd	# Submitted	Submittal/Revision #	Referred			Action					# copies to			
						To	Date Sent	Date Reviewed	Reviewed with no Comments	Reviewed with Comments as Amend and Resubmit	Rejected		Date Ret'd	Contractor	Owner	Field	File
01 32 16	Construction Progress Schedule		6														
01 77 00	Closeout Procedures		6														
03 15 00	Concrete Accessories		6														
03 20 00	Concrete Reinforcing		6														
03 30 00	Cast-In-Place Concrete		6														
03 62 00	Non-Shrink Grouting		6														
07 11 13	Bituminous Dampproofing		6														
07 13 00	Sheet Waterproofing		6														
07 14 00	Fluid-Applied Waterproofing		6														
07 21 13	Board Insulation		6														
07 42 44	Insulation Protection Wall		6														
07 92 00	Joint Sealants		6														
09 96 00	High Performance Coatings		6														

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES SUBMITTAL LOG

PROJECT: PRV and Booster Station
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Spec Section #	Spec Section Title/Product	Date Rec'd	Min. # Req'd	# Submitted	Submittal/Revision #	Referred To	Referred Date Sent	Date Reviewed	Action: Reviewed with no Comments	Action: Reviewed with Comments as Amend and Resubmit	Action: Rejected	Date Ret'd	# copies to: Contractor	# copies to: Owner	# copies to: Field	# copies to: File
26 05 02	Utility Services		6													
26 05 19	Low-Voltage Electrical power		6													
26 05 26	Grounding and Bonding for		6													
26 05 29	Hangers and Supports for		6													
26 05 34	Conduit		6													
26 05 35	Surface Raceways		6													
26 05 53	Identification for Electrical Systems		6													
26 22 00	Low-Voltage Transformers		6													
26 24 16	Panelboards		6													
26 24 19	Motor-Control Centers		6													
26 29 23	Variable-Frequency Motor Controllers		6													
26 36 00	Transfer Switches		6													
26 90 00	Process Instrumentation		6													

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES SUBMITTAL LOG

PROJECT: PRV and Booster Station
CITY OF NEW RICHMOND

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						To	Date Sent	Date Reviewed	Reviewed with no Comments	Reviewed with Comments as Amend and Resubmit	Rejected		Date Ret'd	Contractor	Owner	Field	File
26 90 10	Control Panel Construction		6														
26 90 11	Control Panel Components		6														
26 90 20	Instrumentation Devices		6														
26 90 30	Programmable Logic Controllers		6														
26 90 41	Unlicensed Spread Spectrum Ethernet		6														
31 37 00	Riprap		6														
32 12 16	Asphaltic Concrete Pavement		6														
32 92 19	Seeding		6														
33 10 00	Water Utilities		6														
33 31 13	Public Sanitary Utility Sewerage		6														
33 41 13	Public Storm Utility Drainage Piping		6														
33 49 13	Storm Drainage Manholes, Frames, and Covers		6														

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES SUBMITTAL LOG

PROJECT: PRV and Booster Station
CITY OF NEW RICHMOND

MSA PROJECT NO: 07985049.2

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Spec Section #	Spec Section Title/Product	Date Rec'd	Min. # Req'd	# Submitted	Submittal/Revision #	Referred			Action					# copies to			
						To	Date Sent	Date Reviewed	Reviewed with no Comments	Reviewed with Comments as Amend and Resubmit	Rejected		Date Ret'd	Contractor	Owner	Field	File
40 23 23	Process Piping, Valves and Specialties		6														
44 42 00.01	Prefabricated Booster Pump Station																

SECTION 01 35 00
SPECIAL PROCEDURES

CONTENTS: Work under this section is intended to supplement and/or modify the individual specifications. This section does not relieve the Contractor from fulfilling all items in said sections. The numbers of this section are referenced to those of Specifications Divisions 01 through 44.

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00.01 SPECIFICATION EXPLANATION

A. The Special Procedures items will supplement or supersede the standard specifications. The number preceding special provisions reefers to the standard specifications that are being referenced. Where reference is made to Wisconsin Department of Transportation Specifications, all conditions of said specifications will apply except “Payment and Measurement”.

00.02 BID QUANTITIES

A. All Bid Quantities are estimated. The Contractor shall field verify all quantities and work prior to submitting a Bid.

B. Final quantities shall be adjusted to reflect the field installed quantities. The unit price in the Bid shall not be adjusted though final quantities may vary. Lump sum prices shall not be adjusted. The Engineer’s estimate of quantities as shown in the Bid is approximate and the right is reserved by the Owner to increase or decrease said quantities.

00.03 BID

A. The Contractor’s Base Bid price should be submitted for construction of all work associated with the PRV and Booster Station project as described by the “Advertisement for Bid” in these specifications and as defined by these specifications.

B. It is the intent that the Work under Bid Item 1 shall include all fixed or incidental costs that may not be covered specifically under other bid items. Cost items that may be included under this item may include, but may not be limited to, the following:
   a. Mobilization
   b. Bonds
   c. Insurance
   d. Overhead and Profit
   e. Permits
   f. Project material financing
   g. Project administration and management
   h. Project site facilities, I.E. Job trailers, restrooms, etc.
   i. Temporary utilities
   j. Utility fees
   k. Contractor Mark-up

C. It is the intent that the Work under Bid Item 2 shall include all costs to construct the Booster Station (complete) as defined by the contract documents. This includes all work, materials, and equipment to create a completely functional system.

D. It is the intent that the Work under Bid Item 3 shall include all costs to construct the PRV Station (complete) as defined by the contract documents. This includes all work, materials, and equipment to create a completely functional system.

E. It is the intent that the Work under Bid Item 4 is to cover the direct utility fees for the Electric Utility Allowance for new service to the Booster Station, which is a Lump Sum $50,000 item.

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F. It is the intent that the Work under Bid Item 5 is to cover the direct utility fees for the Natural Gas Utility Allowance for new service to the Booster Station, which is a Lump Sum $5,000 item.

G. It is the intent that the Work under Bid Item 6 is to cover the direct utility fees for the Electric Utility Allowance for new service to the PRV Station, which is a Lump Sum $5,000 item.

DIVISION 31 - EARTHWORK

31.01 SECTION 31 11 00 – CLEARING AND GRUBBING

A. All Bid Quantities are estimated. The Contractor shall field verify all quantities and work prior to submitting a Bid.

B. The Contractor shall perform all clearing and grubbing activities as required. Contractor shall clear and grub all trees, stumps, shrubs, brush piles, and landscaping as shown on the drawings and within the proposed site grading and disturbance limits and otherwise shown in the Plans or as directed by the Engineer in the field.

1. Payment. All costs associated with clearing and grubbing operations, including but not limited to: hauling, disposal, and stump removal shall be considered inclusive to the associate structure.

31.02 SECTION 31 23 16.16 – STRUCTURAL EXCAVATION FOR STRUCTURES

A. The construction of the foundation for the Booster Station, and the materials and methods for structural excavation, backfill and compaction for the foundations, shall be as per the recommendations included in the Geotechnical Investigation Reports (see Section 00 31 32 – Available Project Information) unless otherwise approved by the Engineer.

B. All materials and methods for structural excavation, backfill and compaction shall be as per the recommendations included in the Geotechnical Investigation Report unless otherwise approved by the Engineer. Rock fill and granular backfill material for the building foundation shall be trucked in material and meet the requirements of the Geotechnical Report.

31.03 SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROL

A. Erosion Control. The Contractor shall install erosion control measures to prevent siltation of culvert pipes, adjacent property, and the nearby waterways. Cleaning and/or sediment removal from storm sewers, ditches, private property, or the detention facility due to erosion from the construction site shall be the responsibility of the Contractor at no expense to the Owner. Additional measures shall be installed as necessary to prevent siltation of the culverts, private property, and the nearby waterways. Contractor shall be responsible for the completion of WisDNR required erosion control inspections and reports. Erosion control measures shown on the plans are project minimum requirements. Additional erosion control measures may be required per the "State of Wisconsin Department of Natural Resources Storm Water Management Technical Standards" and/or directed by the Engineer in the field. All technical standards can be found at:

http://dnr.wi.gov/topic/stormwater/standards/const_standards.html

B. Erosion Mat Stabilization. The Contractor shall install biodegradable erosion matting as shown on the drawings, in all ditches where slope is 2% or steeper, on all banks steeper than 4:1, as shown/required on drawings or as directed by the Engineer in the field. Owner and Engineer reserve the right to field-adjust quantities as necessary. Erosion mat installation shall be as specified below:

1. Class I, Type B erosion mats shall be used in all areas unless otherwise identified on plan sheets.
2. Netting for the matting shall be photodegradable and/or biodegradable.
3. The weight of the netting shall not exceed 15% of the total blanket weight.
4. Anchoring devices shall be completely biodegradable as determined by ASTM D 5338-92. Steel wire pins or staples are not acceptable.
5. The anchoring devices shall be shaped, using barbs, twists, bend, or other methods to provide additional mechanical pull resistance when installed in soil. Anchoring devices shall maintain their mechanical anchoring ability for at least 2 months, and substantially degrade within 4 months of warm soil conditions (above 53 degrees Fahrenheit).
6. Product Acceptability. Only products listed in "WDOT Erosion Control Product Acceptability Lists," December 2011 Edition, shall be used for the project.

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7. Shop Drawings. Submit shop drawings on erosion matting and anchors to the Engineer for approval prior to any placement on the project.

END OF SECTION

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SECTION 01 41 26
PERMITS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.
1.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The Contractor shall comply in all ways with the requirements of the following permits:
1. Public Service Commission of Wisconsin Construction Authorization
2. Local and State Building Codes
3. Wisconsin DNR Water System Approval Letter
4. St. Croix County Highway Work in Right-of-Way Permit

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Provide quality control for all work performed under this contract as described in this section.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Material and Equipment - Division 01

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.07 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.08 TOLERANCES

A. Monitor tolerance control of installed products to produce acceptable work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.09 REFERENCES

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

B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.10 MOCK-UP

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups are representative of the quality required for the work.

D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.

1.11 INSPECTING AND TESTING LABORATORY SERVICES

A. Contractor shall be responsible for concrete testing as outlined in Division 03 of these specifications. For other testing, Owner will appoint, contract, and pay for the services of an independent firm to perform inspecting and testing.

B. The independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Engineer or the Owner.

C. Inspecting, testing, and source quality control may occur on or off the project site. Perform off-site inspecting or testing as required by the Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing or inspecting does not relieve Contractor from the responsibility to perform Work to contract requirements.

G. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for retesting will be charged to the Contractor by deducting inspecting or testing charges from the Contract Sum/Price.

1.12 MANUFACTURERS' FIELD SERVICES AND REPORTS

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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, start-up of equipment, and test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report within 30 days of observation to Engineer for information.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 01 45 16.11
CONCRETE QUALITY CONTROL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. American Concrete Institute (ACI), Annual Book of ACI Standards:
   a. ACI 117/177R - Specification for Tolerances for Concrete Construction and Materials and Commentary, Current Edition.
   b. ACI 209.1R - Report on Factors Affecting Shrinkage and Creep of Hardened Concrete, Current Edition.
   c. ACI 301 - Specifications for Structural Concrete, Current Edition.
   d. ACI 302.1R - Guide for Concrete Floor and Slab Construction, Current Edition.
   e. ACI 305R - Hot Weather Concreting, Current Edition.
   f. ACI 306.1 (R2002) - Standard Specification for Cold Weather Concreting, Current Edition.
   g. ACI 311.4R - Guide for Concrete Inspection, Current Edition.
   h. ACI 318/318R - Building Code Requirements for Structural Concrete and Commentary, Current Edition.
   i. ACI 530/530.1/530R/530.1R - Building Code Requirements and Specification for Masonry Structures and Related Commentaries, Current Edition.
   j. ACI ASCC-1(05) - The Contractor's Guide to Quality Concrete Construction, Third Edition.
   k. ACI CP-10/PACK - Craftsman Study Package for ACI Certification of Concrete Flatwork Finisher, Current Edition.
   l. ACI MCP06 - ACI Manual of Concrete Practice, Parts 1 through 6, and Index, 2006 Edition.
   m. ACI SCM-24 - Concrete Repair Basics, Current Edition.
   n. ACI SP-4 - Formwork for Concrete, Current Edition.
   o. ACI SP-15 - Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with Selected ACI Reference, Current Edition.
   p. ACI SP-71 - ASTM Standards in 318, Current Edition.
2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
   a. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field, Current Edition.
   b. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, Current Edition.
   c. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, Current Edition.
   d. ASTM C78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading), Current Edition.
   e. ASTM C114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement, Current Edition.
   f. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete, Current Edition.
   g. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete, Current Edition.
   h. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method, Current Edition.
   i. ASTM C183 - Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement, Current Edition.
   j. ASTM C186 - Standard Test Method for Heat of Hydration of Hydraulic Cement, Current Edition.
   k. ASTM C187 - Standard Test Method for Normal Consistency of Hydraulic Cement, Current Edition.

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l. ASTM C188 - Standard Test Method for Density of Hydraulic Cement, Current Edition.
m. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory, Current Edition.
n. ASTM C219 - Standard Terminology Relating to Hydraulic Cement, Current Edition.
o. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method, Current Edition.
p. ASTM C470 - Standard Specification for Molds for Forming Concrete Test Cylinders Vertically, Current Edition.
q. ASTM C823 - Standard Practice for Examination and Sampling of Hardened Concrete in Constructions, Current Edition.
r. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover sampling and testing of concrete to determine the materials conformance and work conformance to the requirements specified for cast-in-place concrete.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Concrete Accessories - Division 03

C. Cast-in-Place Concrete - Division 03

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 TESTING FOR ACCEPTANCE

A. Samples of concrete shall be delivered to a location on the site where material conformance tests can be performed.
1. Samples of concrete shall be obtained in accordance with ASTM C172.
2. Test specimens shall be stored without being disturbed for the first 24 hours.
3. Contractor's Sampling and Testing. The Contractor, or independent testing laboratory engaged and paid for by the Contractor, as approved by the Engineer, shall conduct tests on the proposed concrete mixture to determine the slump, entrained air content, compressive strength, or other appropriate tests to determine conformance with these specifications. The Contractor shall supply the standard equipment and molds necessary, and the Contractor shall transport the test specimens to the testing laboratory.
4. Owner's Sampling and Testing. The Owner may conduct tests on the proposed concrete mixture to determine the slump, entrained air content, compressive strength, or other appropriate tests to determine conformance with these specifications, as deemed necessary by the Engineer.

B. Slump and Air Content Tests
1. Slump tests shall be made in accordance with ASTM C143. Air content tests shall be made in accordance with ASTM C173 or ASTM C231. Slump tests and air tests shall always be performed from the same batch from which strength tests are performed.
2. If the measured slump or air content falls outside the limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed to meet the requirements of the specifications and shall not be used in the work.

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C. Strength Tests (Contractor's Sampling and Testing for Acceptance). Results from tests conducted by the Contractor shall be considered evidence of compliance of Contractor's materials used in the work, when strength is used as the basis for acceptance.

1. Cylinders for strength tests shall be made in accordance with ASTM C31. During the first 24 hours all test specimens shall be covered and kept at air temperatures between 60 Degrees Fahrenheit and 80 Degrees Fahrenheit in facilities provided on the job site by the Contractor. At the end of 24 hours, specimens will be carefully transported by the Contractor to the testing laboratory, where molds shall be removed, and cylinders shall be cured in a moist condition at 73.4 Degrees Fahrenheit ±3.0 Degrees Fahrenheit until time of test.
2. A strength test for any class of concrete shall consist of four standard cylinders made from a composite sample secured from a single load of concrete in accordance with ASTM C172, with one cylinder tested at 7 days, two at 28 days, and the fourth used as a spare. The test results at 28 days shall be the average of the strength of two specimens determined in accordance with ASTM C39, except that if one specimen in a test shows manifest evidence of improper sampling, molding or testing, it shall be disregarded and the spare cylinder shall be tested.

D. Strength Test (For Early Formwork or Shoring Removal). If the Contractor wishes to remove formwork or shoring prior to the minimum time as specified in Structural Cast-In-Place Concrete Forming - Division 03, they shall, at their expense, prepare test cylinders as evidence of concrete strength as follows:

1. Cylinders shall be made in accordance with ASTM C31. During the period of time from completion of the pour to removal of protective cover and stripping of forms, all test specimens shall be kept with the pour and be subjected to ambient conditions resulting from the curing and protection facilities provided on the job site by the Contractor. At the end of this period, specimens will be carefully transported by the Contractor to the testing laboratory, where molds shall be removed and cylinders shall be stored in outdoor ambient conditions to simulate on job site conditions until time of test.
2. A minimum of two cylinders made from a composite sample secured from a single load of concrete in accordance with ASTM C172. The test results shall be the average of the strength of two specimens determined in accordance with ASTM C39, except that if one specimen in a test shows manifest evidence of improper sampling, molding or testing, it shall be disregarded.

3.02 SELECTION OF TESTING LABORATORY

A. An independent testing laboratory to perform Concrete Quality Control shall meet the requirements of ASTM E329. The laboratory shall be selected by the Contractor as approved by the Engineer.

3.03 TEST REPORTS

A. Test reports will be directly distributed by the laboratory as follows: The original to the Contractor; two copies to the Engineer; one copy to the Owner.

3.04 TESTING REQUIREMENTS

A. The Contractor shall be required to perform one test for each 100 cubic yards of concrete poured, or fraction thereof, for each class of concrete used. Each test shall consist of four (4) cylinders; one (1) to be tested at seven (7) days, two (2) to be tested at twenty-eight (28) days, and one (1) to be a spare.

B. Compliance testing shall be performed on every single load, or portion thereof, where water addition to the single load, or portion thereof, takes place on site.

C. A minimum of one (1) test shall be performed per day for each class of concrete placed.

3.05 CONDITIONS OF COMPLIANCE AND NON-COMPLIANCE

A. Compliance of Contractor's Materials Used in the Work.

1. To conform to the requirements of this specification, every 28-day test representing each mix must be equal to or greater than the specified minimum strength without exception. If a specimen shows manifest evidence of improper sampling, molding, or testing, it will be disregarded. Note,

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however, that the anticipated strength for all mixes is appreciably above the specified minimum strength due to quality required by the water-cement ratio specified.

B. Non-Compliance of Contractor's Materials Used in the Work

1. When strength is used as the basis for acceptance, should individual tests of the Contractor's specimens produce strengths less than 90% of the specified strength (f'c), tests of cores drilled from the area in question may be required in accordance with ASTM C42. Three cores shall be taken for each cylinder test less than 90% of the specified strength (f'c). If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80°F, relative humidity less than 60 percent) for seven (7) days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.
2. Concrete represented by the core tests will be considered structurally adequate and meet the requirements of this specification if the average of the three cores is equal to at least 95 percent of the specified strength (f'c) and if no single core is less than 90 percent of f'c. To check testing accuracy, locations represented by erratic core strengths may be retested. If these strength acceptance criteria are not met by the core tests, the Engineer shall order appropriate action at no additional cost to the Owner.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Concrete quality control shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 CONCRETE QUALITY CONTROL

A. Concrete Quality Control, Inclusive. All required sampling, preparing of specimen and testing, except as modified by these specifications shall be performed by the Contractor, or an independent testing laboratory engaged and paid for by the Contractor and shall be inclusive to payment for work associated with cast-in-place concrete.

1. The cost of any additional testing required because of failure of previous tests to meet specification requirements shall be borne by the Owner for subsequent tests which comply with the specifications.
2. The cost of any additional testing required because of failure of concrete to meet specification requirements shall be borne by the Contractor for tests which fail to comply with the specifications. All tests required under Paragraph 3.05 "Conditions of Compliance and Non-Compliance", above shall be borne by the Contractor.
3. Concrete Quality Control, Lump Sum. When so provided, payment for concrete quality control shall be made at the contract lump sum price bid.

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover all materials, equipment, tools, labor and supervision necessary to execute the temporary facilities and controls required for the work.

B. Contractor shall be responsible to obtain from authorities of each respective utility the necessary service for water, electricity, telephone, etc., or make arrangements with the Owner for some or all of these services as specified below.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (NONE)

PART 3 EXECUTION (N/A)

3.01 TEMPORARY ELECTRIC

A. The Contractor shall be responsible for coordinating the installation of primary electric service to the site. Contractor shall be responsible for all work associated with obtaining temporary electric service. Meter for temporary electric service shall be in Contractor's name, and Contractor shall be responsible for all electric power bills for the temporary service until Substantial Completion has been granted by Owner.

3.02 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations.

B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be utilized during construction.

3.03 TEMPORARY HEATING

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A. Heat enclosed areas to achieve curing of materials, to dissipate humidity, and to in general provide with environmental conditions required for construction operations.
   1. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.
   2. Enclose building prior to activating temporary heat in accordance with Enclosures article in this section.
   3. Operation of new permanent equipment for temporary heating purposes is not allowed.
   4. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelope. Combustion gas shall not be allowed in any temporary enclosure and building envelope.

3.04 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
   1. Provide and pay for ventilation devices and as needed to maintain specified conditions for construction operations. Provide separate metering and reimburse Owner for cost of energy used.
   2. Operation of new permanent equipment for temporary ventilating purposes is not allowed.

3.05 TEMPORARY WATER

A. Provide, maintain and pay for temporary water. Exercise measures to conserve water. Coordinate access to and use of water with utility provider, extend and supplement with temporary devices as needed to maintain specified conditions for construction operations.

3.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

3.07 TEMPORARY FIELD OFFICES AND SHEDS

A. Do not use existing facilities for field offices or for storage.

B. Do not use permanent facilities for field offices or for storage.

C. Provide space and facilities for Project as required.

D. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

3.08 VEHICULAR ACCESS

A. Provide unimpeded access for emergency vehicles. Maintain 20 foot wide driveways with turning space between and around combustible materials.

B. Provide and maintain access to fire hydrants and control valves free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Use designated existing on-site roads for construction traffic.

3.09 TEMPORARY PARKING

A. Arrange for temporary parking areas to accommodate construction personnel. Use of designated areas of existing parking facilities used by construction personnel is permitted. Locate as approved by Owner. Coordinate specific requirements with Owner.

B. When site space is not adequate, provide additional off-site parking.

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C. Use of existing on-site streets and driveways used for construction traffic is permitted. Tracked vehicles not allowed on paved areas.

D. Do not allow heavy vehicles or construction equipment in parking areas.

E. Do not allow heavy vehicle parking on existing pavement.

F. Permanent Pavements and Parking Facilities:
1. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
2. Use of permanent parking structures is not permitted.

G. Maintenance:
1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

H. Removal, Repair:
1. Remove temporary materials and construction when permanent paving is usable.
2. Remove underground work and compacted materials to depth of 2 foot fill and grade site as specified.
3. Repair existing facilities damaged by use, to original or better than condition.

I. Mud From Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

3.10 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

3.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Provide protection for facilities designated to remain. Replace damaged facilities.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

3.12 TEMPORARY ENCLOSURES

A. Exterior Enclosures:
1. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance

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of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

B. Interior Enclosures:
   1. Provide temporary partitions and ceilings as indicated on contract drawings to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.
   2. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:

3.13 TEMPORARY SECURITY

A. Security Program:
   1. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
   2. Initiate program in coordination with Owner's existing security system at project mobilization.
   3. Maintain program throughout construction period until Owner acceptance precludes need for Contractor security.

B. Entry Control:
   1. Owner will control entrance of persons and vehicles related to Owner's operations.
   2. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

3.14 TEMPORARY WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

3.15 TEMPORARY DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

3.16 TEMPORARY EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

3.17 NOISE CONTROL (N/A)

3.18 PEST CONTROL (N/A)

3.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion inspection.

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B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on contract drawings.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 4 MEASUREMENT AND PAYMENT

4.01 TEMPORARY FACILITIES AND CONTROLS

A. Temporary facilities and controls shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Temporary Facilities and Controls, Lump Sum. When so provided, payment for temporary facilities and controls shall be made at the contract lump sum price bid.
2. Temporary Facilities and Controls, Inclusive. When no quantity is provided, temporary facilities and controls shall be in inclusive to payment for work associated with related utility or infrastructure improvement.

END OF SECTION

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SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, current edition.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall include installing and maintaining traffic control devices to safely and efficiently direct traffic through or around the construction site.

B. The work also includes removing temporary traffic control devices at the completion of the project.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Work Restrictions and Provisions – Division 01

C. Submittals – Division 01

D. Permits – Division 01

1.05 SUBMITTALS (N/A)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (N/A)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

A. Traffic control devices and materials shall conform to the MUTCD and applicable State Department of Transportation specifications.

B. All Contractors shall comply with the approved traffic control plan and schedule as included in the Contract Drawings. It shall be the Contractor's responsibility to notify the St. Croix County Department of Transportation a minimum of 72 hours in advance of to coordinate the installation and removal of said traffic control devices associated with the proposed work along County Road K.

C. The Contractor shall review all applicable permit provisions and conditions. The St. Croix County Utility Accommodation Policy can be viewed with the following link:
   1. Utility, Right of Way, Driveway and Oversized/Overweight Permits | St. Croix County, WI

D. Contractor shall provide all necessary temporary traffic control devices per Wisconsin DOT standard requirements for the means and methods of work selected by the Contractor. The Contractor shall provide minimum Wisconsin DOT required traffic control devices along County Road K and Fox Way while work is occurring within the County's Right-of-way.

PART 3 EXECUTION

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3.01 TRAFFIC CONTROL

A. The Contractor is required for providing traffic control necessary to control the project sites, protect their work, prevent injury, and provide safe movement through or across the project as necessary. The Contractor shall submit a traffic control plan to the Engineer for review two weeks prior to the start of construction.

B. Keep driveways clear and available to the property owners, the Owner's employees, and emergency vehicles, at all times. Do not use these areas for parking or storage without prior written permission from the property owner. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. The construction site shall be accessible by emergency services at all times.

D. All exposed existing and new utilities (manholes, valve boxes, inlets, etc.) shall be marked with a construction barrel or board at all times during construction.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Traffic control shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 TRAFFIC CONTROL

A. Traffic Control, Inclusive. When no quantity is provided, traffic control shall be considered inclusive to payment for contract work related to the associated construction.

END OF SECTION

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SECTION 01 60 00
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK (NONE)

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Quality Control - Division 01

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.07 REQUIREMENTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

1.08 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.09 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturers' instructions, with seals and labels intact and legible.

B. Store sensitive Products in weathertight, climate controlled enclosures.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide insured off-site storage and protection when site does not permit on-site storage or protection.

E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product.

F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

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1.10 OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.11 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only within 30 days after date established in Notice to Proceed. Approval or disapproval of a substitution after bidding is entirely at the Engineer's discretion.

B. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that the Contractor:
   1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
   2. Will provide the same warranty for the Substitution as for the specified Product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit one copy of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit Submittals, Product Data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
   3. The Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover: starting of systems; demonstration and instructions; testing, adjusting and balancing; operation and maintenance data; protecting installed and completed construction; final cleaning; manuals for materials and finishes; manual for equipment and systems; spare parts and maintenance products; product warranties, guarantees and bonds; project closeout procedures; and maintenance service.

B. The Contractor shall assume the responsibility for the protection of all finished construction until accepted by the Owner. The Contractor shall repair and restore any and all damage to finished work to the satisfaction of the Engineer.

C. The Contractor shall require each trade to clean the premises of accumulations of surplus materials and rubbish caused by their activities. Burning of rubbish on site will not be permitted.

1.04 RELATED WORK ELSEWHERE

A. (ALL SECTIONS)

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Provide operation and maintenance manuals covering each item of equipment furnished. Submit manuals to Engineer prior to “Substantial Completion” in accordance with Submittals - Division 01 of these specifications, and as specified herein.

B. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers.

C. Prepare binder cover with printed title “OPERATION AND MAINTENANCE INSTRUCTIONS”, title of project, and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare Table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and supplier. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.

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e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Originals of warranties and bonds.

1.06 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Clean filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.07 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and Owner seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Submittals-Division 01 that equipment or system has been properly installed and is functioning correctly.

1.08 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

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C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at schedule time, at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. Required instruction time for each item of equipment and system is specified in individual sections.

1.09 TESTING, ADJUSTING AND BALANCING

A. The completed Work in accordance with requirements of the contract documents when ready in all respects for use by the Owner shall be subjected to a performance test at operating conditions.

B. Submit reports to Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents. Make all adjustments necessary to fulfill requirements and to comply with the instructions and recommendations of manufacturers, and to comply with all codes and regulations.

1.10 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.11 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.

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3. Changes made by Addenda and modifications.

F. Record Drawings [and Shop Drawings]: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.

G. Submit documents to Engineer prior to claim for final Application for Payment.

1.12 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.13 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form with 10 days after final inspection.

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E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, control, and communications typed.

G. Include color-coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color-coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Quality Control – Division 01.

S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.14 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.15 PRODUCT WARRANTIES, GUARANTEES AND BONDS

A. Obtain warranties, guarantees and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

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D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.16 LOOSE AND DETACHABLE PARTS

A. The Contractor shall retain all loose and small detachable parts of apparatus and equipment furnished under this contract, until completion of the work and shall turn them over to the Owner.

1.17 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Provide submittals to Engineer for presentation to Owner required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all portions of building as specified in Summary of Work – Division 01.

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION (N/A)

PART 4 MEASUREMENT AND PAYMENT (N/A)

END OF SECTION

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SECTION 02 01 00
MAINTENANCE OF EXISTING CONDITIONS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover all materials, equipment, supervision, and labor necessary for surface restoration. The various street surfaces disturbed, damaged, or destroyed during the performance of the work under this contract shall be restored and maintained as shown, specified, and directed. Included in this classification are pavement surfaces of all types, pavement bases, shoulders, and appurtenances as driveways, curb and gutter sections, sidewalks, alleys, and all other miscellaneous surfaces required but not designated under other sections of these specifications.

B. A schedule of restoration of the pavement surfaces shall be worked out by the Contractor and approved by the Engineer. The schedule shall be adhered to unless subsequent changes are approved by the Engineer.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Cast-in-Place Concrete - Division 03

C. Subgrade Preparation - Division 31

D. Trenching and Backfill - Division 31

E. Aggregate Base and Subbase - Division 32

F. Asphaltic Concrete Pavement - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

A. Materials shall comply with the respective sections of Divisions 03, 31, and 32 of these specifications, as they are applicable, and those of the State of Wisconsin, Department of Transportation, Standard Specifications to the extent indicated by the reference thereto.

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2.02 PAVEMENT SURFACE AND APPURTENANCES

A. Asphaltic concrete pavement and appurtenances shall conform to the requirements specified in Asphaltic Concrete Pavement - Division 32 or as specified in Special Procedures - Division 01.

B. Concrete pavement and appurtenances shall conform to the requirements specified in Cast-in-Place Concrete - Division 03 or as specified in Special Procedures - Division 01.

PART 3 EXECUTION

3.01 GENERAL

A. Workmanship shall comply with the respective sections of Divisions 03, 31, and 32 of these specifications, as they are applicable, and those of the State of Wisconsin, Department of Transportation, Standard Specifications to the extent indicated by the reference thereto.

3.02 TEMPORARY RESTORATION

A. Upon completion of backfilling, the pavement surface damaged or destroyed shall be temporarily restored by the Contractor.
   1. The pavement shall be temporarily restored by placing on a prepared subgrade a base consisting of crushed gravel or crushed stone. The base shall have a minimum thickness of 8 inches plus the thickness of the permanent type of pavement to be replaced, or greater thickness if necessary to conform to the thickness of the base disturbed or removed, and shall be placed at the proper line and grade.
   2. Temporary pavement shall be maintained in a suitable and safe condition for traffic until the permanent pavement is laid.

B. Type I backfill shall be used under all paved streets, paved roads, driveways, sidewalks and curb and gutter sections.

C. Curbs, where possible, shall be temporarily reset in their place as a part of the temporary restoration. Damaged or destroyed sidewalks shall be temporarily restored by placing a 3-inch layer of granular base material, or other approved material.

3.03 PERMANENT RESTORATION

A. Preparation for pavement and appurtenance replacements may proceed after trenches have been compacted in accordance with Trenching and Backfill - Division 31. Level and grade, fill, or re-excavate as necessary. Neatly trim any adjacent permanent pavement by a sawcut joint prior to pavement replacement.
   1. Base material shall be in accordance with Aggregate Base Course - Division 32 and to a depth of 8 inches or as specified in Special Procedures - Division 01.
   2. Asphaltic concrete pavement shall be in accordance with Asphaltic Concrete Pavement - Division 32 and to a depth of 3 inches or as specified in Special Procedures - Division 01.
   3. Concrete pavement and appurtenances shall be in accordance with Cast-in-Place Concrete - Division 03 and shall be to a depth of 8 inches or as specified in Special Procedures - Division 01. Concrete pavement reinforcement shall be equal to or exceeding that existing.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Maintenance of existing conditions shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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4.02 MAINTENANCE OF EXISTING CONDITIONS

A. Maintenance of Existing Conditions, Lump Sum. When so provided, payment for maintenance of existing conditions shall be made at the contract lump sum price bid.

B. Maintenance of Existing Conditions, Inclusive. When no quantity is provided, maintenance of existing conditions shall be considered inclusive to payment for work associated.

END OF SECTION

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SECTION 03 11 13
STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Concrete Institute (ACI) Annual Book of ACI Standards:
      a. ACI 117/177R - Specifications for Tolerances for Concrete Construction and Materials and Commentary, Current Edition.
      b. ACI 301 - Specifications for Structural Concrete, Current Edition.
      c. ACI 302.1R - Guide for Concrete Floor and Slab Construction, Current Edition.
      d. ACI 311.4R - Guide for Concrete Inspection, Current Edition.
      e. ACI 318 - Building Code Requirements for Structural Concrete, Current Edition.
      f. ACI 347 - Guide to Formwork for Concrete, Current Edition.
      g. ACI ASCC-1(05) - The Contractor's Guide to Quality Concrete Construction, Third Edition.
      h. ACI SCM-24 - Concrete Repair Basics, Current Edition.
      i. ACI SP-4 - Formwork for Concrete, Current Edition.
      j. ACI SP15 – Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with Selected ACI Reference, Current Edition.
      k. ACI SP-71 - ASTM Standards in ACI 318, Current Edition.
   2. American Plywood Association (APA) Specifications and Standards:
      a. APA PS1 - Plywood Design Specification, Current Edition.

1.04 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all materials, equipment and labor required to furnish all formwork for cast-in-place concrete as shown on the contract drawings and specified herein.

B. The work shall include formwork, shoring for cast-in-place concrete, and installation into formwork of items by other such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings and other items to be embedded in concrete.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Concrete Accessories - Division 03

C. Concrete Reinforcing - Division 03

D. Cast-in-Place Concrete - Division 03

E. Joint Sealers – Division 07

1.06 SUBMITTALS (NONE)

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 USE OF AMERICAN IRON AND STEEL COMPLIANCE

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A. All iron and steel products used in this project must comply with the “Use of American Iron and Steel” clause of the H.R. 3547 “Consolidated Appropriations Act, 2014” or are the subject of a waiver approved by the Funding Agency or designee.

2.03 DESIGN

A. The design and engineering of the formwork and its accessories shall be the responsibility of the Contractor. Formwork shall be designed, erected, supported, braced and maintained so as to safely support all vertical and lateral loads until such loads can be supported by the concrete structure.

B. Determination of loads and design shall be in accordance with ACI 301 and ACI 347.

2.04 FORMS

A. Forms may be wood, plywood, concrete-form-grade hardboard, metal or other acceptable material which will produce smooth, true surfaces.
   1. Provide lumber dressed on at least two edges and one side for tight fit.
   2. Metal forms shall have smooth surfaces free from any pattern, irregularities, dents, bends and sags.

2.05 SHORING

A. All shoring members shall be of such design and material to safely support all dead and working loads throughout the placing and curing period. Shoring shall be placed to prevent sagging and settlement.

2.06 FORM TIES AND ACCESSORIES

A. Form ties shall be factory-fabricated, adjustable-length, removable or snapoff metal, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

B. For exposed concrete surfaces, provide ties so that the portion remaining with the concrete after removal is 1 inch to 1-1/2 inches inside the finished face of the concrete.

C. Unless otherwise indicated, provide form ties which will not leave holes larger than 1 inch in diameter in concrete surfaces.

2.07 FORM COATING COMPOUND

A. Form coating compound shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces and not impede the wetting of surfaces to be cured with water or curing compounds. Forms for concrete surfaces requiring subsequent treatment shall receive a type of coating that will not impair bond or adhesion.

B. Form coating compound for steel forms shall conform with all requirements stated above and shall be of rust-preventative type.

PART 3 EXECUTION

3.02 GENERAL

A. Responsibility. The design and construction of formwork shall be the sole responsibility of the Contractor.

B. Earth forms are not acceptable or permitted.

C. Construct forms to the exact sizes, shapes, lines and dimensions shown, as required to obtain accurate alignment, location, grades, level and plumb in finished construction and to maintain tolerances in accordance with ACI 301. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Chamfer all corners of concrete exposed to view using chamfer strips. Use selected materials to obtain required finishes.

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D. Forms shall be sufficiently tight to prevent leakage of concrete. Temporary openings shall be provided in the inside form of all wall forms and in column forms to facilitate cleaning and inspection immediately before placing concrete.

E. Assemble forms so their removal will not damage concrete and adjacent materials.

3.03 FORMWORK

A. Forms shall conform in general to shape, line, grade and dimensions of members as shown on contract drawings, and shall have the strength and stability to insure finished concrete within the tolerances specified in ACI 347.
   1. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from those other trades.
   2. Exterior edges of all exposed concrete, unless otherwise specified, shall have a chamfer strip placed in form to provide bevel of sharp edges. Chamfer strips shall be 3/4-inch by 3/4-inch by 45º wood, plastic, or rubber.
   3. Accurately place and secure in position, prior to placing concrete, all anchors, bolts, inserts and other items furnished under other sections of the specifications and for other contractors on the project.

B. Formwork shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports.

C. Formwork shall be properly braced or tied together so as to maintain position and shape and insure safety to workman and passersby.

D. Temporary openings may be provided on all wall and column forms to limit the free fall of the concrete to less than 4 feet and should be so located as to facilitate the placing and consolidation of the concrete. The ports shall be spaced no more than 6 feet apart to limit the horizontal flow of concrete.

E. All forms shall be cleaned and rubbed smooth prior to placing to insure true forming surfaces for all concrete surfaces.

3.04 FORM TIES AND ACCESSORIES

A. Internal wall ties shall contain positive stops at the required wall thickness. The exterior clamp portions of the pipe shall be adjustable to permit tightening of forms. Ties shall provide a positive disconnection 1 inch to l-1/2 inches inside the finished face of the concrete. Cutting ties back from face of wall or use of wire ties will not be permitted. All tie and plug holes shall be filled with non-shrink grout after forms are removed.

B. All concrete tie locations shall be watertight. Wall ties shall be fitted with tapered rubber plugs at all locations specified under Special Procedures - Division 01.

C. Accessories shall be used only for the purpose intended and shall in no way interfere with the placing of concrete. Removal of accessories shall in no way impair or disturb finish concrete surfaces. Accessories shall be compatible with formwork and ties and shall maintain the watertight integrity of the formwork system.

D. Design of all form ties and accessories shall be adequate for all concrete placement, horizontal and vertical, to prevent failures and blowouts.

3.05 FORM COATINGS

A. Coat form contact surfaces with form bond breaker compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

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C. Clean reinforcing steel that has become contaminated with form coating to the satisfaction of the Engineer prior to placing concrete.

3.06 EMBEDDED ITEMS

A. Items embedded in concrete shall be properly cleaned to be free from oil or foreign matter that would weaken the bond of the concrete to these items.

B. Install in the formwork requisite inserts, anchors, sleeves and other items specified under other sections of these specifications; close end conduits, piping and sleeves embedded in concrete with caps or plugs.

C. Conduits or pipes embedded in slabs of larger outside diameter than 1-1/2 inches, or when pipes and conduits come closer than 1 inch from either the upper or lower surface of the slab, provide expanded metal or wire mesh laid and extended beyond conduit or piping at least 8 inches on all sides; space conduits or pipes closer than 3 diameters on centers, place to avoid changing locations of reinforcement for indicated locations.

3.07 CONSTRUCTION JOINTS

A. Make construction joints where indicated on the contract drawings; additional construction joints are subject to prior approval of the Engineer; locate additional construction joints to least impair the strength of the structure.

B. Form keyways and joints as indicated on the contract drawings.

C. Continue reinforcing steel and wire fabric across construction joints, unless noted otherwise.

D. Install premolded joint filler at locations indicated on the contract drawings; extend filler from bottom of concrete; joints shall be carefully cleaned, free from dust, mortar or other loose materials before installation; seal as indicated on the contract drawings.

E. Make splices in premolded filler in manner to preclude penetration of concrete between joint faces.

3.08 EXPANSION JOINTS

A. Expansion joints shall be placed where indicated on the contract drawings; reinforcement, corner protection angles or other fixed metal items embedded in or binded to continuously shall not extend through expansion joints; finish concrete slab edges along expansion joints neatly with slightly rounded edging tool; leave joints in the completed work carefully tooled and free of mortar and concrete.

B. Joints between slabs on earth and vertical surfaces, including columns, piers, walls, machinery foundation and other fixed structures shall have expansion joint material placed on abutting vertical surfaces.

C. Joints to receive joint compound shall have premolded expansion filler strips at proper level placed below finished floor with slightly tapered, dressed, oiled wood strip secured temporarily to top thereof; install wood strip of depth to form groove at least 1 inch deep; after concrete has set, remove strip; fill groove with light colored joint compound for poured application; fill joint grooves flush, to be slightly concave, after drying as specified in Joint Sealers - Division 07.

3.09 CONTROL JOINTS

A. Install vertical control joints as indicated on the contract drawings, and where not indicated not more than 20 feet apart; locate specifically as follows:
   1. Align with window jambs or at center of window openings; place not over 10 feet from corners or offsets; where concrete walls change either thickness or height; where change in wall sections occurs.
   2. At each control joint, extend only alternate horizontal reinforcement bars through the joint; seal control joints with concrete colored joint compound.

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B. Install control (contraction) joints in slabs as indicated on the contract drawings, and where not indicated locate specifically as follows:
   1. Space at a minimum of 25 feet on center; locate at column spacings where practical; at each joint, cut reinforcing mesh so only alternate wires extend through joint.
   2. If column spacing exceeds 25 feet on center, provide intermediate joints as well; resulting panels shall be approximately square; elongated and L-shaped panels shall not be acceptable.
   3. Provide 1/4 inch wide saw - cut control joints to a depth equivalent to 1/3 the slab thickness; cut as soon as the slab will support the weight of the saw and operator and not damage the surface and not more than 8 hours after completion of concrete placement.

C. Apply joint compound to all control and construction joints after concrete has sufficiently cured; clean joint slot; fill joint with light colored compound for poured application; fill joint grooves flush, to be slightly concave after drying, as specified in Joint Sealers - Division 07.

3.10 FORM/SHORING REMOVAL

A. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

B. Removal of forms shall be accomplished in such a manner as will prevent injury to concrete and insure complete safety of structure. Removal times listed below are minimum and may be increased by the Engineer as job conditions warrant.
   1. Where structure as a whole is supported on shores, vertical forms such as beam and girder sides, columns, and similar vertical forms may be removed 24 hours after completion of pour, providing concrete has hardened sufficiently to sustain its own weight and to prevent injury.
   2. Wall forms shall not be removed in less than 24 hours after pouring, unless otherwise required for curing.
   3. Supporting forms and shoring must remain in place until concrete can carry any loads to be imposed upon it and in no case shall be removed in less than seven (7) days.
   4. Forms ties, requiring any operation in removal of forms which would tend to destroy bond between tie and concrete in order to remove form, shall not be disturbed for seven (7) days after completion of pour.
   5. The time periods stipulated above may be reduced if strength results of concrete so indicate adequate conditions.

C. Notify the Engineer before the forms are removed in order that an examination of the newly-stripped surfaces may be made prior to patching.

3.11 REPAIR TIE HOLES

A. After removal of form tie, the holes shall be filled as follows:
   1. Thoroughly clean and dampen.
   2. Fill solid with patching mortar.

B. Make repairs uniform in color and finish with surrounding concrete.

3.12 EXPOSED SURFACES

A. Exposed surfaces shall be Carborundum rubbed to take off fins; fill pores, stone pickets, honeycombs, etc., with non shrink grout as follows:
   1. Repair immediately after form removal and inspection by the Engineer.
   2. Remove concrete surrounding defect to sound concrete, then wet affected area.
   3. Brush on bonding agent, mixed and applied in accordance with manufacturer's recommendations.
   4. Consolidate patch grout and strike off to leave the patch slightly higher than the surrounding surface.
   5. Finish the repaired area flush with the surrounding area after the patch has been in place for one hour, or as prescribed by the manufacturer.

B. Perform patching before curing compound is applied; cure patched areas in the same manner as adjacent concrete; make repairs uniform in color and finish with surrounding concrete.

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C. Exposed surfaces shall be protected from excessive sun, wind and rain, and kept wet until curing compound is applied. When ambient temperature falls below 40ºF heat aggregate and mixing water; clear all forms, reinforcement and subgrade of snow and ice; cover all freshly placed concrete with tarpaulins, and provide heat to maintain a temperature of 70ºF for at least three days or 50ºF for five days; rate of cooling after end of protection period shall be accomplished in a manner approved by the Engineer.

3.13 REUSE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for the new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

C. Do not use “patched” forms for concrete surfaces exposed to view.

PART 4 MEASUREMENT AND PAYMENT

4.02 GENERAL

A. Structural cast-in-place concrete forming shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

A. Structural Cast-in-Place Concrete Forming, Inclusive. When no quantity is provided, structural cast-in-place concrete forming shall be considered inclusive to payment for work associated with cast-in-place concrete.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
      a. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete, Current Edition.
      b. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions, Current Edition.
      c. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation, Current Edition.
      d. ASTM C639 - Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants, Current Edition.
      e. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer, Current Edition.
      f. ASTM C679 - Standard Test Method for Tack-Free Time of Elastomeric Sealants, Current Edition.
      g. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete, Current Edition.
      h. ASTM C882 - Standard Test Method for Bond Strength for Epoxy-Resin Systems Used with Concrete by Slant Shear, Current Edition.
      i. ASTM C884 - Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay, Current Edition.
      j. ASTM C920 - Standard Specification for Elastomeric Joint Sealants, Current Edition.
      k. ASTM D6 – Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds, Current Edition.
      l. ASTM D297 – Standard Test Methods for Rubber Products - Chemical Analysis, Current Edition.
      m. ASTM D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type), Current Edition.
      n. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), Current Edition.
      o. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction, Current Edition.
      p. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover, Current Edition.
      q. ASTM E1643-98 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
      r. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. Federal Specification TTS 227 and TTS 230, Current Edition.

1.04 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing concrete accessories as shown on the contract drawings and specified herein.

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1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Structural Cast-In-Place Concrete Forming - Division 03

C. Cast-in-Place Concrete - Division 03

1.06 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to the rate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 EXPANSION AND CONTRACTION JOINT FILLER

A. Premolded Tongue and Groove. Premolded tongue and groove joint for slabs-on-grade, 1/4 inch thick; with depth to match slab.
1. Joint filler shall be Sonneborn Expansion-Joint Filler, as manufactured by Degussa Building Systems, or equal.

B. Preformed Bituminous. Bituminous expansion and contraction joint filler shall be preformed bituminous strips which complies with ASTM D994.

C. Preformed Sponge Rubber. Sponge rubber expansion and contraction joint filler shall be preformed which complies with ASTM D1752.

D. Preformed Cork. Cork expansion and contraction joint filler shall be preformed which complies with ASTM D1752.

E. Rigid Insulation. Polystyrene insulation, ASTM C578, Type X, extruded cellular type, 5 year aged R-value of 5.0 minimum at 75°F water absorption in accordance with ASTM C272 of 0.1 percent by volume maximum, minimum 15 psi compressive strength, 0.5 inch thick.

F. Removable Plastic Expansion Joint Cap: Snap-Cap by W.R. Meadows.

2.03 BOND BREAKER

A. Cast-in-Place Concrete Flatwork. Asphalt impregnated felts, 15 pound.

B. Cast-in-Place Concrete Formwork. Non-staining liquid product which imparts a waterproof film to prevent adhesion of concrete and will not leave a paint-impeding coating on the face of the concrete.

2.04 VAPOR BARRIER

A. Under Slab Vapor Barrier: 10 mil reinforced polyethylene film for under slab application. Retarder shall meet or exceed all requirements of ASTM E1745 Classes A, B and C.

B. Seam Tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.

C. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

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2.05 WATERPROOF SHEET MATERIAL FOR CURING

A. Provide one of the following, complying with ASTM C171: waterproof paper, polyethylene film or polyethylene-coated burlap.

B. Use only materials which are resistant to decay when tested in accordance with ASTM E154, as follows:
   1. Polyethylene sheet not less than 6 mils thick; or
   2. Water resistant barrier paper consisting of heavy papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side.

2.06 CONCRETE REPAIR COMPOUND

A. Concrete repair compound shall be Sonopatch, Sonneborn Building Products; Embeco 411 Mortar, Master Builders, or equal.

2.07 PIPE SLEEVES, ANCHOR BOLTS AND CAST IRON GROOVES

A. Shall be furnished, installed, and anchored solid in their final location.

PART 3 EXECUTION

3.02 INSTALLATION

A. Install accessories where shown on contract drawings and as specified herein.

B. Place bond breaker at junctures of slabs-on-grade with vertical walls.

C. Install under-slab vapor barrier at locations shown on Drawings in accordance with manufacturer's instructions and ASTM E1643-98. Unroll vapor barrier with the longest dimension parallel with the direction of the pour. Lap vapor barrier over footings and seal to foundation walls, unless shown otherwise on Drawings. Overlap joints 6-inches and seal with manufacturer's tape. Seal all penetrations (including pipes) with manufacturer's pipe boot. No penetrations of the vapor barrier are allowed except for reinforcing and permanent utilities. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6-inches and taping all four sides with tape.

D. Install premolded tongue and groove joint according to manufacturer's instructions; brace securely to prevent displacement.

E. Seal all exposed surfaces of expansion and contraction joints with joint sealer (3/4 inch deep and hold 1/8 inch below surface of concrete).

PART 4 MEASUREMENT AND PAYMENT

4.02 GENERAL

A. Concrete accessories shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 CONCRETE ACCESSORIES

A. Concrete Accessories, Inclusive. When no quantity is provided, concrete accessories shall be considered inclusive to payment for work associated with cast-in-place concrete.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Concrete Institute (ACI) Specifications and Standards:
      a. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures, Current Edition.
      b. ACI 318 - Building Code Requirements for Structural Concrete and Commentary, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
      a. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement, Current Edition.
      b. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement, Current Edition.
      c. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Current Edition.
      d. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plan and Deformed, for Concrete, Current Edition.
   3. American Welding Society (AWS), Specifications and Standards:
      a. AWS D12.1 - Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction, Current Edition.
   4. American Association of State Highway Transportation Officials (AASHTO), Specifications and Standards:
      a. AASHTO M182 - Specification for Burlap Cloth Made from Jute or Kenaf, Current Edition
   5. Concrete Reinforcing Steel Institute (CRSI) Specifications and Standards:
      a. CRSI - Manual of Standard Practice, Current Edition.
      b. CRSI - Recommended Practice for Placing Reinforcing Bars, Current Edition.
      c. CRSI - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature, Current Edition.
      d. CRSI - Recommended Practice for Reinforcing Bar Splices, Current Edition.

1.04 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing concrete reinforcing as shown on the contract drawings and as specified herein.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Concrete Accessories - Division 03

C. Cast-in-Place Concrete - Division 03

1.06 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specification. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

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1. Submit detailed reinforcing drawings prepared in accordance with ACI 315, including bar schedule with bar marks and bends indicated.
2. Comply with CRSI Manual of Standard Practice showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete.
3. Verify dimensions and make proper allowance for fitting together work of other trades.

B. Submit a certification attesting that reinforcing steel meets the requirements of ASTM A615, including Supplementary Requirements S1, and that welded steel wire fabric meets the requirements of ASTM A185.
1. Submit certified copies of mill reports, tensile and bend tests for reinforcing steel on projects where the quantity of reinforcing exceeds 15 tons.
2. For information only, submit manufacturer's data and instruction for proprietary items, including reinforcement and accessories.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 REINFORCEMENT

A. Steel Bar Reinforcement. Main reinforcing and stirrups; ASTM A615, Grade 60.

B. Welded Wire Fabric. Welded wire fabric, flat sheets, ASTM A1064, 6x6-W2.9xW2.9, unless otherwise specified or indicated on the contract drawings.

C. Steel Tie Wire. Steel tie wire, ASTM A82, plain, cold-drawn, 16 gauge or heavier.

D. Supports For Reinforcement. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place complying with CRSI Manual of Standard Practice. For slabs on grade where base material will not support chairs, use supports with sand plates or horizontal runners to locate mesh properly in slab. Provide hot-dipped galvanized or plastic-coated accessories in contact with forms for sight exposed concrete; stainless steel accessories for sandblasted or bushhammered concrete.

PART 3 EXECUTION

3.02 FABRICATION

A. Fabricate and place to shapes and dimensions indicated or required to carry out intent of contract drawings and these specifications.

B. Bends for stirrups and ties shall be made around a pin having a diameter not less than four times the diameter of reinforcing bar. Bends for other bars shall be made around a pin having a diameter not less than six times diameter of bar, except that for bars larger than 1 inch, pin shall be not less than eight times diameter of bar.
1. Perform cutting and bending in the shop; bend and cut steel cold. Heating of reinforcement will not be permitted. Do not bend or straighten bars in a manner that will injure the material.
2. Field bending of bars shall not be allowed without the Engineer's approval.

C. Tagging shall be with metal, linen, or rope fiber tags filled in with machine or waterproof ink. Paper tags shall not be allowed.

D. Reinforcing bars shall conform accurately to the dimensions shown on the contract drawings.

3.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. For reinforcing steel fabricated on-site, shop from the mill in bundles, limited to one size and length, tagged with a waterproof tag showing the name of the mill, heat number, grade and size of the bars and identifying number.

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B. For reinforcing steel fabricated off-site, deliver in bundles identified as to structure and shop drawing number. Identify each individual bar with a waterproof tag showing the grade, size and bar mark from the approved bar schedule.

C. Protect reinforcing steel and wire fabric from damage and from dirt, oil grease, other foreign matter, and rust-causing condition. Do not store reinforcement in direct contact with the ground.

3.04 CLEANING

A. Before placing and before pouring concrete, all reinforcement shall be thoroughly cleaned of all oil, dirt, loose mill scale, loose rust, or foreign matter that will destroy or reduce bond.

3.05 PLACING REINFORCEMENT

A. Placement. Metal reinforcement shall be accurately placed in accordance with approved Submittals and adequately secured in position by concrete or metal chairs or spacers. Nails shall not be driven into forms to support reinforcement nor shall wire ties come in contact with forms.

B. Splicing. Lap at splices shall be sufficient to transfer stress between bars by bond and shear.
1. Furnish reinforcing bars in full lengths as indicated on the contract drawings and approved Submittals.
2. Do not splice bars unless indicated on the contract drawings or approved by the Engineer in writing. When authorized, make splices in accordance with ACI 318; perform welding in accordance with AWS D12.1.
3. Splices generally shall be avoided at points of maximum stress. Minimum splice lap for stressed bars shall be forty times bar diameter.

C. Offsets in longitudinal bars at change of cross section shall be placed in region of lateral support. Slope of inclined portion of offset shall not be more than one in six and, in tied columns, ties shall be spaced not over 3 inches on centers for a distance of 1 foot below actual point of offset.

D. Embedded Items. The Contractor shall provide for the installation of all items embedded in the concrete, such as coil rod inserts, anchor bolts, dowels, etc., as shown on the contract drawings or as provided for in other Divisions of these specifications.
1. All dowel bars shall be tied securely in place before pouring concrete.
2. Provide for clearances with appurtenant materials and devices.

E. Drilled and Grouted or Epoxy Dowel Installation. Existing concrete which will be incorporated into new work and requiring integration with new concrete will be doweled as indicated on the contract drawings and as follows:
1. Drill hole in existing concrete of size that is 3/4 inch larger in diameter than diameter of dowel bar. Incline the hole in the concrete such that the non-shrink grouting or epoxy will be retained in the hole.
2. Fill hole with non-shrink grouting or epoxy.
3. Immediately place dowel bar into hole.
4. Allow grout or epoxy to take initial set before disturbing dowel bar.

F. Steel Reinforcing Fabric. Reinforce as detailed on the contract drawings; and where not indicated, reinforce with wire fabric, place 2 inches from the top of the slab.
1. Flat sheets shall be used whenever available. Wire fabric shall lap 6 inches on side joints and 12 inches on end joints. Properly secure with annealed wire. Fabric shall be raised and secured in the correct location using permanent supports. Raising the fabric by hook during placement of concrete shall NOT be permitted.
2. Alternately, in tight quarters and around appurtenances and openings, lap mesh reinforcement not less than one mesh space plus 2 inches, and tie.

G. Concrete Cover. The minimum cover of concrete for all reinforcement shall conform to the dimensions indicated on the contract drawings, which indicate the clear distance from the edge and end of the

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reinforcement to the face of the concrete surface. Provide clearance and spacing indicated on the contract drawings and approved Submittals, where so indicated.

1. Where no clearances are indicated, the thickness of the concrete cover over reinforcement shall be as follows:
    a. Concrete cast against and permanently exposed to earth - 3 inches;
    b. Formed concrete exposed to earth or weather - 2 inches;
    c. Formed concrete not exposed to earth or weather - 1-1/2 inches;
    d. Slabs not exposed to earth or weather - 1 inch.

PART 4 MEASUREMENT AND PAYMENT

4.02 GENERAL

A. Concrete reinforcing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 CONCRETE REINFORCING

A. Concrete Reinforcing, Inclusive. When no quantity is provided, concrete reinforcing shall be considered inclusive to payment for work associated with cast-in-place concrete.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Concrete Institute (ACI), Annual Book of ACI Standards:
      a. ACI 117/177R - Standard Specification for Tolerances for Concrete Construction and Materials and Commentary, Current Edition.
      b. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, Current Edition.
      c. ACI 209.1R - Report on Factors Affecting Shrinkage and Creep of Hardened Concrete, Current Edition.
      d. ACI 301 - Specification for Structural Concrete, Current Edition.
      e. ACI 302.1R - Guide for Concrete Floor and Slab Construction, Current Edition.
      f. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete, Current Edition.
      g. ACI 305R - Hot Weather Concreting, Current Edition.
      h. ACI 306.1 (R2002) - Standard Specification for Cold Weather Concreting, Current Edition.
      i. ACI 308R - Guide to Curing Concrete, Current Edition.
      j. ACI 309R - Guide for Consolidation of Concrete, Current Edition.
      k. ACI 311.4R - Guide for Concrete Inspection, Current Edition.
      l. ACI 318/318R - Building Code Requirements for Structural Concrete and Commentary, Current Edition.
      m. ACI 530/530.1/530R/530.1R - Building Code Requirements for Commentary for Masonry Structures and Specification for Masonry Structures and Related Commentaries, Current Edition.
      n. ACI ASCC-1(05) - The Contractor's Guide to Quality Concrete Construction, Third Edition.
      o. ACI CP-10/PACK - Craftsman Study Package for ACI Certification of Concrete Flatwork Technician/Finisher, Current Edition.
      p. ACI MCP06 - ACI Manual of Concrete Practice, Parts 1 through 6, and Index, 2006 Edition.
      q. ACI SCM-24 - Concrete Repair Basics, Current Edition.
      r. ACI SP4 - Formwork for Concrete, Current Edition.
      s. ACI SP15 - Field Reference Manual: Standard Specifications for Structural Concrete ACI 301 with Selected ACI Reference, Current Edition.
      t. ACI SP-71 - ASTM Standards in ACI 318, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
      a. ASTM C33 - Standard Specification for Concrete Aggregates, Current Edition.
      b. ASTM C70 - Standard Test Method for Surface Moisture in Fine Aggregate, Current Edition.
      c. ASTM C94 - Standard Specification for Ready-Mixed Concrete, Current Edition.
      d. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or [50 mm] Cube Specimens), Current Edition.
      e. ASTM C125 - Standard Terminology Relating to Concrete and Concrete Aggregates, Current Edition.
      f. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate, Current Edition.
      g. ASTM C128 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate, Current Edition.

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h. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, Current Edition.
i. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete, Current Edition.
j. ASTM C150 - Standard Specification for Portland Cement, Current Edition.
k. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete, Current Edition.
l. ASTM C191 - Standard Test Methods for Time Setting of Hydraulic Cement by Vicat Needle, Current Edition.
m. ASTM C219 - Standard Terminology Relating to Hydraulic Cement, Current Edition.
n. ASTM C226 - Standard Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement, Current Edition.
o. ASTM C233 - Standard Test Method for Air-Entraining Admixtures in Concrete, Current Edition.
p. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete, Current Edition.
q. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for use as a Mineral Admixture in Portland-Cement Concrete, Current Edition.
r. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Current Edition.
s. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete, Current Edition.
t. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, Current Edition.
u. ASTM C566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying, Current Edition.
v. ASTM C595 - Standard Specification for Blended Hydraulic Cement, Current Edition.
w. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzlan for Use in Concrete, Current Edition.
x. ASTM C688 - Standard Specification for Functional Additions for Use in Hydraulic Cements, Current Edition.
y. ASTM C989 - Standard Specification for Slag Cement for Use in Cement and Mortars, current edition.

3. Portland Cement Association (PCA) Standards and Specifications:
   a. PCA - Design and Control of Concrete Mixtures, Current Edition.

1.04 DESCRIPTION OF WORK

A. The work covered under this section shall cover furnishing all materials, equipment and labor required to construct all cast-in-place concrete as shown on the contract drawings and as specified.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Concrete Quality Control - Division 01

D. Structural Cast-in-Place Concrete Forming - Division 03

E. Concrete Accessories - Division 03

F. Concrete Reinforcing - Division 03

1.06 SUBMITTALS

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A. Submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specification. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

B. Concrete Design Mix
1. Prior to the start of placing of concrete, submit the design mix for each class of concrete, indicating that the concrete constituents and proportions will result in a concrete mix meeting the physical requirements for each class of concrete specified. Submit with the design mix, laboratory test reports and manufacturer's certificates attesting the conformance of constituents with these specifications.
2. Do not vary the proportions of the constituents or source of material of the approved mix without submitting corresponding test result documentation to the Engineer for review and approval.
3. Design mix shall indicate proportions of cement, aggregate and water, and names and proportions of admixtures and air-entraining agents.
4. Provide certification that the design mix complies with all ACI and ASTM requirements.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 CEMENT

A. Cement shall be Portland Cement ASTM C150 Type I or IA or ASTM C595 Class IL, except as otherwise noted or approved.

1. Type III cement shall only be used for Class L concrete, or when approved by the Engineer.

2. ASTM C150 Type I or IA, Type II, and Type III, and ASTM C595 blended cement types IL, IP, and IS shall be used for exterior flatwork as approved by the Engineer.

B. A singular brand and manufacturer of cement shall be used for the entire work.

2.03 FLY ASH

A. Fly ash shall conform to ASTM C618 Class C.

B. A singular source of fly ash shall be used for the entire work.

2.04 SLAG

A. Slag shall be ground granulated blast furnace slag conforming to ASTM C989.

2.05 AGGREGATE

A. Aggregate shall consist of clean, hard durable sand, gravel, crushed gravel or crushed rock.

B. Aggregate shall conform to the requirements of ASTM C33. Fine and coarse aggregate shall meet ASTM C33 grading requirements. Coarse aggregates shall be graded in accordance with ASTM gradations as follows:
1. 3/4 inch maximum coarse aggregate - ASTM No. 67
2. 1-1/2 inch maximum coarse aggregate - ASTM No. 4

C. Maximum aggregate size shall be as defined in the Concrete Schedule, or where not defined in the Concrete Schedule, as defined by dimensional constraints for cast-in-place concrete as follows.
1. Not larger than one-fifth of the narrowest dimension between sides of the forms;
2. Not larger than one-third the thickness of the slab;

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3. Not larger than three-fourths of the minimum clear spacing between individual reinforcing bars or wire, bundles of bars, or prestressing tendons or ducts.

2.06 MIXING WATER

A. Mixing water shall be natural or treated water, clean and free from injurious amount of oil, acid, alkali, chlorides and sulfates, other common salts, organic matter or other deleterious substances.

B. Mixing water shall yield cement paste complying with the requirements ASTM C109 and ASTM C191.

2.07 ADMIXTURES

A. All admixtures are subject to the written approval of the Engineer and shall be used in strict accordance with the manufacturer's recommendations.
   1. Air-Entraining Admixture
      a. All concrete exposed to weather and freeze-thaw cycles shall be air-entrained, unless otherwise specified.
      b. Air-Entraining admixture shall conform to ASTM C260.
      c. Air-Entrainment shall be as indicated for each class as in the Concrete Schedule.
   2. Water-Reducing, Set-Controlling Admixtures
      a. Water-Reducing, Set-Controlling admixtures shall conform to ASTM C494, Type A for water-reducing, Type C for accelerating, Type D for water-reducing and retarding, and Type E for water-reducing and accelerating. Type F for water reducing, high range, and Type G for water reducing, high range and retarding.

B. Admixtures containing calcium chloride or soluble chloride shall not be used.

2.08 CURING AND SEALING COMPOUND - INTERIOR

A. Membrane-forming curing compound shall meet the moisture retention requirements of ASTM C309, Type 1. Kure 200W, Sonneborn Division of BASF; Sealtight CS-309 Curing and Sealing Compound, W.R. Meadows, Inc.; Eucocure, Euclid Chemical Co.; or equal.

B. Shall be compatible with surface finish.

2.09 CURING COMPOUND - EXTERIOR

A. Curing compound shall comply with ASTM C309, Type 2; resin, white pigmented.

PART 3 EXECUTION

3.02 COORDINATION

A. Examine the drawings and specifications for work of other sections or other contractors and coordinate such work with the requirements of this Section; make provisions for installation of such items as sleeves, pipes, conduits, inserts and hangers in a manner that will not impair or weaken concrete construction.

3.03 READI-MIX CONCRETE

A. Acceptability and Use. Readi-mix concrete shall be designed on the basis of strength, durability, impermeability, and exposure condition, as required for the intended use of the structure by methods specified in ACI 211.1 and ACI 318. All readi-mix concrete shall comply with the water-cement ratio for each specific class of concrete as specified in the Concrete Schedule. Concrete design mix, complete with sample test results shall be submitted to the Engineer for approval prior to placing any concrete.
   1. Failure to Meet Strength Requirements. Failure to meet strength requirements shall be as defined in Concrete Quality Control- Division 01 of these specifications.
   2. Watertight Concrete. All concrete exposed to earth or water shall be watertight, shall have a water-cement ratio as specified, and shall be air-entrained as specified in the Concrete Schedule.

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a. Construct keyways as indicated on the contract drawings.
b. Provide damp-proofing membrane as indicated on the contract drawings.

B. Mix Proportioning. Mix proportioning shall be the responsibility of the Contractor and shall be submitted for review and approval by the Engineer, in accordance with these specifications.
1. Select proportions for concrete to obtain the quality requirements for the class of concrete as specified in the Concrete Schedule. Contractor, at their expense, shall have an approved independent laboratory prepare design mixes for each specified concrete class.
2. Slump. Slump for class of concrete shall be as specified in the Concrete Schedule. The Contractor shall at their expense, make field slump tests in accordance with ASTM C143 and Concrete Quality Control-Division 01 of these specifications.
3. Adjustment to Concrete Mixes. Design mix adjustments may be requested by the Contractor when characteristics of materials, conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised design mixes and strength results shall be submitted and approved before using in the work. No change in contract price will be allowed for these changes.
4. Addition of Water to the Batch. Addition of water to the batch delivered to the site shall be in strict accordance with ASTM C94. This shall be the Contractor's responsibility and by their direction, following consultation with the Engineer.
a. Addition of water to the batch shall be one time only. Total gallons of water added to the batch shall be recorded on the load ticket, which shall be supplied to the Engineer prior to that delivery truck leaving the site. If water is permitted to be added to mixed concrete upon arrival at the job, an additional mixing of 30 revolutions of the drum shall be required.
b. Contractor shall adjust the water-cement ratio of the batch to the corresponding value based on the addition of water to the batch and shall submit this information to the Engineer with adjusted strength data for the final batch proportion.
c. At no time shall the addition of water cause the water-cement ratio specified in the concrete class schedule to be exceeded.

3.04 GENERAL

A. Unless otherwise specified, conform to ACI 304, 305, and 306 for concrete installation requirements such as preparation, mixing, conveying, depositing, curing, and cold and hot weather requirements; consolidate concrete in accordance with ACI 309.

B. Concrete not placed within 90 minutes or 300 revolutions, whichever occurs first, after the first mixing of the cement and aggregates will be rejected.

C. Contractor shall indicate on record set of Drawings at site, for review prior to installation, a pouring program for concrete work showing unit of operation, method of pouring, installation of construction/control joints, expansion joints and all necessary work.

D. Proper grade marker or stakes shall be used by Contractor to establish grades for ramps, platforms, sidewalks, slopes to drains, inlets, etc.

E. Trenches, forms, conveying equipment shall be prepared to receive concrete in accordance with ACI 304.

F. Place concrete footings upon undistributed clean surfaces, free from frost, ice, mud and water; when foundation is on dry soil or pervious material, lay waterproof sheathing paper over earth surfaces to receive concrete.

G. Rock surfaces upon which concrete is to be placed, make level, clean, free from all objectionable coatings, water, mud, debris, loose semi-detached or unsound fragments; level surfaces to receive sand cushion placed to minimum thickness of 2 inches.

H. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature and mechanical injury; maintain with minimum moisture loss and relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.

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I. All freshly cast concrete shall be protected from damaging effects of the elements freezing, rapid drop in temperature and loss of moisture and from future construction operations.

3.05 PREPARATION OF EQUIPMENT AND PLACE OF DEPOSIT

A. Before placement, clean equipment for mixing and transporting the concrete; remove debris and ice from all surfaces upon which concrete is placed; clean reinforcement of dirt, loose rust, and mill scale, or other coatings.

B. Remove water from all areas before depositing concrete; before depositing new concrete on or against concrete that has set, thoroughly roughen; clean existing surfaces of laitance, foreign matter or loose particles; retighten forms; slush existing surfaces with neat cement grout coat; place new concrete before grout has attained initial set; give horizontal construction joints grout brush coat of cement, fine aggregate, in same proportions as concrete to be placed.

C. Thoroughly wet the stone base on which slabs are to be placed where no vapor barrier is indicated.

D. Check compaction of fill and proper grade for slabs-on-grade. Check screeds and exercise care to prevent disturbing screeds during placement. Provide for construction joints in slabs-on-grade at 20 feet maximum in each direction unless shown otherwise on the contract drawings. Place expansion joint material at junctures of slabs-on-grade with vertical walls and as otherwise shown.

E. Remove debris, excess form oil, and water from formwork; avoid washing newly deposited concrete.

3.06 MIXING

A. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 and ACI 304. The production facilities shall comply with the requirements of the National Ready Mixed Concrete Association Certification Plan as regards materials storage and handling, batching equipment, central mixer, truck mixers, agitators, non-agitating units, ticketing system, etc.

B. Do not over-mix; do not use concrete which is retained in mixers so long as to require additional water in excess of design mix water to permit satisfactory placing; retempering of mix is not permitted.

C. Concrete shall be delivered to the site of the work and the mixed concrete discharged completely within 1-1/2 hours after water has been added to cement. In hot weather, or under conditions contributing to quick stiffening of concrete, this time may be reduced by the Engineer.

D. Concrete delivered shall arrive at the site having a temperature not less than 50 Degrees F nor greater than 85 Degrees F, unless otherwise permitted by the Engineer.

3.07 CONVEYING

A. Convey concrete from the mixer to the final deposit by methods that will prevent segregation or loss of materials.

B. Use of aluminum conveyances is not permitted.

3.08 CONCRETE PLACEMENT

A. Place concrete, including drops greater than 60 inches using recommended practices in accordance with ACI 304 and ACI 318. Once pouring operation commences, it shall be carried out as a continuous operation until a section is completed.

B. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing; do not use vibrators to move concrete horizontally within the forms.

C. Do not use retempered concrete or concrete contaminated by foreign material.

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D. Plan and conduct concrete placement to insure that the concrete is kept plastic and that the concrete is free of cold joints.

E. Where there is a time delay greater than 45-minutes between adjacent concrete placement, a bulkhead construction joint, complete with waterstops where required, must be installed.

F. Do not commence placing when the sun, heat, wind or limitations of facilities provided prevent proper finishing or curing.

G. Discontinue concreting when the descending natural air temperature falls lower than 40 Degrees Fahrenheit unless preparations are made and in place to heat or insulate concrete in accordance with the cold weather concreting requirements of this specification.

H. Concrete for walls shall be deposited in approximately horizontal layers not to exceed 18 inches in height to avoid segregation due to rehandling and flowing.

I. Concrete shall not be placed or poured in water. Water level shall be removed or lowered in a manner approved by Engineer. Excess water shall not be permitted. Powdering a mixture of cement to absorb excess water shall not be permitted.

J. Concrete shall be placed before initial set has occurred. Placing should be carried on in such manner that the concrete in the form is still plastic and can be integrated with fresh concrete.

K. Contractor shall notify Engineer of concrete pouring schedule one day in advance of pour to allow for inspection of reinforcing and forms.

L. Bottom dump buckets may be used for transporting mixed concrete to the desired location. Particular care shall be taken to avoid jarring or bumping as this may cause segregation.

M. Where chutes are used to transport concrete, they shall be of metal or wood with metal lining and should have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials. The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the form.

N. Elephant trunks and/or tremies shall be used in walls and columns to prevent free fall of the concrete and to allow the concrete to be placed through the cage of reinforcing steel.

O. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity. Loss of slump in pumping shall not exceed 1-1/2 inches.

3.09 CONSOLIDATION

A. Each concrete layer placed shall be compacted by mechanical internal vibrating equipment supplemented by hand spading, rodding, or tamping.

B. The period of concrete vibration shall not be less than two seconds nor more than five seconds at any one point.

C. Consolidate concrete thoroughly as it is placed in order to secure a dense mass; work concrete well around the reinforcement and embedded items and into the corners of the forms.

D. Use internal vibrators inserted vertically over the entire area of the placement; form vibrators not permitted; internal vibrators shall maintain a minimum of 5000 impulses when submerged in concrete.

E. Vibrate until voids are eliminated, coarse aggregate is suspended in mortar, and entrapped air bubbles begin to rise to the surface; concrete should move back into the space vacated by the vibrator; vibration duration shall be limited only to the time necessary to produce consolidation without causing segregation.

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F. Space vibrator insertions such that the area visibly affected by the vibrator overlaps the adjacent just-vibrated area by a few inches.

G. Penetrate at least 6 inches into previously placed layers in order to bond between layers and avoid cold joints.

H. Take care not to over-vibrate air entrained concrete; place vibrator to eliminate honeycombing but avoid excess vibrating that bleeds all entrapped air from the mix.

I. Do not use vibrators to transport concrete.

3.10 JOINTS AND KEYWAYS

A. Construct expansion, control, and isolation joints and keyways only where indicated on the drawings or at additional locations approved by the Engineer (and as shown on the Standard Details).

B. Where the placing of concrete is discontinued, clean off laitance and other objectionable material to a sufficient depth to expose sound concrete as soon as concrete is firm enough to retain its form; smooth the top surface of concrete adjacent to the forms with a trowel to minimize visible joints on exposed faces.

C. Immediately upon completion of the work of placing concrete, remove accumulations splashed upon the reinforcement and the surfaces of the forms; perform this removal before concrete takes its initial set; clean reinforcing steel carefully to prevent damage to the concrete steel bond.

D. Do not halt work within 18 inches of the top of any face.

E. For bonded horizontal joint construction, roughen the surface and expose the aggregate; clean the surface thoroughly by wet sandblasting, by cutting with high-pressure water jet or by other approved methods; perform cleaning after the concrete has hardened to prevent raveling of the surface below the desired depth.

F. Before bonding concrete is placed, clean the surface of loose or soft particles or other objectionable materials and keep wet for a minimum period of 12 hours.

G. Cover the cleaned and saturated surface with a coating of neat cement grout and deposit new concrete before the grout has attained its initial set.

3.11 CURING

A. Concrete shall be wet cured by immersion of moisture-retaining covers in conformance with ACI 308 or shall receive curing compound in accordance with ACI 309.

B. Water curing is the preferred method of protection for curing concrete other than under hot weather conditions; cover exposed surfaces with a saturated material (burlap or cotton mats) and keep wet continuously with a soil soaker hose for 7 curing days for all concrete except high early strength concrete; leave covering in place, without wetting, for an additional 3 days.

C. A curing day is defined as 24-hour day when the concrete surfaces are kept moist and the uniform temperature of the concrete mass is between 55 Degrees Fahrenheit and 75 Degrees Fahrenheit.

D. Curing shall start as soon as free surface water disappears after finishing. Where forms are not removed immediately, curing shall be accomplished in a manner acceptable to the Engineer.

E. Curing compounds may not be used on surfaces that are to receive additional concrete, paint or tile.

F. Curing and sealing compound shall not be applied to steel reinforcing anchors, water stops, construction joints, or surfaces to be bonded to other concrete.

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G. When using a curing compound, keep surfaces moist after the forms are removed, and the form tie holes repaired; after the surfaces are finished, apply the curing compound according to the manufacturer's recommendations; remove forms only as required to advance repair of tie holes and minor defects.

H. Slabs: Immediately following slab finishing, apply liquid membrane-forming curing compound or begin water curing before the surface becomes dry.

I. Vertical Surfaces: When the forms are removed entirely, spray the surface with water and allow it to reach a uniformly damp appearance with no free water on the surface; apply curing compound or begin water curing.

J. For curing concrete under hot weather conditions, see Hot Weather Requirements in this section.

K. For curing concrete under cold weather conditions, see Cold Weather Requirements in this section.

3.12 CONCRETE WALL FINISHES

A. Complete screeding and darbying of top of walls before excess moisture or bleeding water is present on the surface.

B. Do not begin subsequent finishing operations until surface water has disappeared.

C. Refer to Concrete Schedule, included in this specification section, for finish type at each location, defined as follows:
   1. Rough Form Finish: (Type W1)
      a. No form facing materials specified.
      b. Patch tie holes and defects.
      c. Chip off fins 1/4 inch or more in height.
   2. Smooth Form Finish: (Type W2)
      a. Use a form facing material that will produce a smooth, hard, uniform texture on the concrete.
      b. Keep seams to a practical minimum.
      c. Patch tie holes and defects.
      d. Remove all fins.
   3. Smooth Rubbed Finish: (Type W3)
      a. Produce a Smooth Form Finish.
      b. Wet surface and rub with a Carborundum brick until uniform color and texture are produced.
      c. Perform rubbing no later than 24 hours after forms are removed.
      d. Do not use any cement grout other than the paste drawn from the concrete itself by rubbing.
      e. Thoroughly wash the surface with water.
   4. Smooth Troweled Finish: (Type W4)
      a. Produce a Smooth Rubbed Finish.
      b. After wet-rubbing, finish with a steel trowel to increase compaction of fines and to provide maximum density.

3.13 CONCRETE SLAB FINISHING

A. Complete screeding and darbying slabs before excess moisture or bleeding water is present on the surface.

B. Do not begin subsequent finishing operations until surface water has disappeared and the concrete will sustain foot pressure with only approximately 1/4 inch indentation.

C. Refer to Concrete Schedule, included in this specification section, for finish type at each location, defined as follows:
   1. Smooth Float Finish: (Type S1)
      a. Consolidate concrete with a power-driven disc-type float or a combination floating-troweling machine with metal float shoes attached.

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b. Machines which have a water attachment for wetting the concrete during the finishing operation are prohibited.
c. Check and level surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge. Cut down high spots and fill low spots; immediately after re-leveling, refloat surface to a uniform, smooth, granular texture.
d. Where slab drainage is indicated, take care to maintain accurate slopes for drainage.

2. Steel Troweled Finish: (Type S2)
a. Produce a Smooth Float Finish.
b. After float finishing, steel trowel surface as specified in Concrete Schedule to increase the compaction of fines and to provide maximum density and wear resistance.
c. Steel Troweled Finish: Screed and bull float or darby. Give preliminary float finish, true, even and free from depressions; float surface with hand or machine floats; compact surface with not less than 2 thorough and complete steel troweling operations.
d. Tolerance on finished steel troweled floors in no instance shall exceed 1/8 inch in 10'-0" on surface; where floor drains occur, slope floors to drains.
e. Buffing: After concrete floors have been properly cured, buff thoroughly to remove soluble salt incrustation or other foreign substances.

3. Broom Finish: (Type S4)
a. Draw stiff broom over previous Smooth Float Finish, to obtain non-slip finish.

3.14 CONCRETE SIDEWALKS

A. Concrete sidewalk construction shall be as specified in Concrete Sidewalks, Steps, Driveways and Retaining Walls - Division 32 of these specifications.

3.15 CONCRETE CURB AND GUTTER

A. Concrete curb and gutter construction shall be as specified in Concrete Curb and Gutter - Division 32 of these specifications.

3.16 CONCRETE WHEEL BUMPER BLOCKS

A. Shall be reinforced precast concrete, minimum 4000 psi, with air entrainment; maximum height 6 inches; install where indicated on Drawings.

3.17 CONCRETE SPLASH BLOCKS

A. Reinforced precast concrete splash blocks formed of 4000 psi concrete with air entrained concrete; shall be 2 inches thick x 1'-0" wide x 2'-6" long; front shall be turned up 4 inches for 6 inches overall height; upper corners of turned up lip shall be cut off at 45 Degree angle; wire mesh reinforcing turned up in front lip.

3.18 PERIMETER INSULATION

A. Install perimeter insulation at building foundation wall and under floor slab as shown on the contract drawings.

3.19 HOT WEATHER REQUIREMENTS

A. Comply with ACI 305R unless otherwise specified herein below.

B. Hot weather conditions are deemed to exist when the temperature in the forms is 75 Degrees Fahrenheit or above, or a combination of high air temperature, low relative humidity and wind velocity impair the quality of fresh or hardened concrete; take protective measures for mixing, transporting and placing concrete in accordance with ACI 305R.

C. The temperature of the concrete at the place of discharge may not exceed 85 Degrees Fahrenheit.

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1. If ice is used to lower temperature, place crushed, shaved or chipped ice directly into the mixer as part or all of the mixing water; mix until ice is completely melted.
2. Record the concrete temperature at the time of discharge.

D. Do not add water that will cause the proportions to exceed the maximum water-cement ratio shown in Table I.
1. Notify the Engineer before adding any water to the concrete mix.
2. Record the amount of water added to the concrete at the jobsite.

E. Discharge concrete within 45 minutes or 100 revolutions, whichever occurs first, after the first mixing of cement and aggregates.

F. Placing and Curing:
1. Place concrete promptly upon arrival.
2. Provide at least one standby vibrator for each 3 vibrators in use.
3. Protect concrete from direct sunlight; keep forms covered and moist by means of water sprinkling or the application of continuously wetted burlap or cotton mats for a minimum of 24 hours. Windbreaks and/or sunshades shall be provided as directed by the Engineer.
4. When forms are removed, provide wet cover to the newly exposed surfaces to avoid exposure to hot sun and wind.
5. Continue specified water curing methods for 10 days; leave covering in place 4 additional days; do not permit alternate wetting and drying cycles.
6. For slabs on grade, beam and deck concrete, and other horizontal placements protect the surface between finishing operations using one or more of the following methods:
   a. Careful use of a fog nozzle.
   b. Spreading and removing polyethylene sheeting between finishing operations.
   c. Application of mono-molecular film after the strike-off.

G. During extremes in weather, floor slabs shall not be cast unless the slab is protected by a roof and other suitable protective measures are provided. After curing has been completed, the floor shall be exposed to the air for 48 hours prior to allowing traffic on the floors.

3.20 COLD WEATHER REQUIREMENTS

A. Comply with ACI 306.1 (R2002) unless otherwise specified herein below.

B. Cold weather is defined any time when the daily temperature is 40 Degrees Fahrenheit or lower during placement and the protection period. If at any time during the progress of the work, the temperature drops below 40 Degrees F., the Contractor shall make suitable provisions to protect the concrete by use of insulation materials such as blankets, mats, etc., and equipment for providing artificial heat.

C. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelope. Combustion gases shall not be allowed in any temporary enclosure and building envelope.

D. Protect concrete surfaces from freezing for at least 24 hours after placement.

E. All surfaces in contact with newly-placed concrete including formwork, reinforcement and subgrade must be above 35 Degrees Fahrenheit.

F. Use preparation methods capable of producing concrete with a temperature not more than 85 Degrees Fahrenheit, and not less than 55 Degrees Fahrenheit, at the time of placement.

G. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, within the specified temperatures. (Do not heat water in excess of 140 Degrees Fahrenheit.)

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H. Concrete shall have a temperature of not less than 55 Degrees Fahrenheit when placed; mix concrete at a temperature between:
   1. 60 Degrees Fahrenheit and 70 Degrees Fahrenheit when outside air temperature is above 30 Degrees Fahrenheit.
   2. 65 Degrees Fahrenheit and 75 Degrees Fahrenheit when outside air temperature is between 0 Degrees Fahrenheit and 30 Degrees Fahrenheit.
   3. 70 Degrees Fahrenheit and 80 Degrees Fahrenheit when outside air temperature is below 0 Degrees Fahrenheit.

I. Follow concrete placement with tarpaulins or other readily movable coverings, so only a few feet of concrete is exposed to the outside air at any time.

J. Maintain the temperature and moisture conditions specified in all parts of the newly placed concrete by covering, insulating, housing or heating; arrange for protection methods in advance of placement.

K. Maintain concrete at a temperature of not less than 55 Degrees Fahrenheit nor more than 70 Degrees Fahrenheit for a period of 3 days after placement.

L. A thermometer accurate to plus or minus 2 Degrees F shall be placed under the curing blanket. Additional insulation shall be supplied as required to maintain the temperature above 55 Degrees F.

M. After the curing period, the temperature of the exposed surface shall not be permitted to drop faster than 30 Degrees F in 24 hours.

N. Do not remove forms during the initial protection period.

O. Protect insulation against wetting that will impair its insulating value using moisture-proof cover material; keep insulation in close contact with concrete.

P. Construct enclosure to withstand wind and snow loads and be reasonably airtight; provide sufficient space between the concrete and enclosure to permit free circulation of heated air.

Q. Use vented heaters; do not permit heaters to heat or dry concrete locally. Unvented salamanders or other heaters which produce carbon dioxide as by-products shall not be permitted within enclosures or inside buildings. If heaters are used, precautions shall be taken to prevent drying of the slab through the use of water jackets or other suitable methods.

R. Maintain relative humidity above 40% within heated enclosures before construction supports are removed.

S. Monitor temperature to insure concrete is kept within specified limits recording time and concrete temperature every 8 hours.

T. Assure concrete has developed necessary strength before removing forms; provide additional test cylinders with the same protection as the structure they represent to verify concrete strength before construction supports are removed.

U. If water curing is used, terminate at least 12-hours before end of temperature protection period. Permit concrete to dry.

V. After the required protection period gradually reduce the concrete temperature within an enclosure or insulation at a rate not to exceed 20 Degrees Fahrenheit per day until the outside temperature has been reached.

W. Apply membrane forming curing compound to concrete surfaces during the first period of above-freezing temperatures after forms are stripped and before air temperature rises to 50 Degrees Fahrenheit; apply membrane forming curing compound to slabs as soon as finishing operations are completed, except where live steam curing is used.

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3.21 DELIVERY TICKETS

A. With each load of concrete delivered to the job there shall be furnished by the ready-mixed concrete producer duplicate delivery tickets, one for the Contractor and one for the Engineer. Delivery tickets shall provide the following information:

1. Date and serial number of ticket;
2. Name of ready-mixed concrete plant;
3. Job location;
4. Contractor;
5. Type and brand name of cement;
6. Mix number or specified cement content in bags per cubic yard of concrete;
7. Truck number;
8. Time dispatched stamped by a time clock;
9. Amount of concrete in load in cubic yards;
10. Admixtures in concrete, if any;
11. Maximum size of aggregate;
12. Water added at job, if any;
13. Slump of concrete ordered

TABLE 1
CONCRETE CLASS SCHEDULE

Parameter Maximum	Compressive Strength (PSI) Maximum	Water-Cement Ratio Maximum	Air Content Range (%) Minimum-Maximum	Slump Range (Inches) Minimum-	Coarse Aggregate (Inches)	Value	28-Day
Class A	4,000	0.5	1 to 2	2 to 4	3/4		
Class B	4,000	0.5	1 to 2	2 to 4	1-1/2		
Class C	4,000	0.5	5 to 7	2 to 4	3/4		
Class D	4,000	0.5	4 to 6	2 to 4	1-1/2		
Class E (Interior)	3,000	0.5	1 to 2	2 to 4	3/4		
Class F (Exterior)	3,000	0.5	5 to 7	2 to 4	1-1/2		
Class G	2,000	0.67	1 to 2	4 to 6	1-1/2		
Class H	5,000	0.45	1 to 2	2 to 4	3/4		
Class I	5,000	0.45	1 to 2	2 to 4	1-1/2		
Class J	5,000	0.45	5 to 7	2 to 4	3/4		
Class K (Exterior)	5,000	0.45	4 to 6	2 to 4	1-1/2		
Class L	3,000 psi @24 hours	0.40	5 to 7 4 to 6	2 to 4 2 to 4	3/4 1-1/2		

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TABLE 2
CONCRETE SCHEDULE
USES AND PROPERTIES

Use	Finish	Class and Considerations
Structural		
Foundations and footings,	W1	Class A
(non-exposed)	W1	Class B
Exposed foundations	S2 Top, W4 Sides	Class C
	S2 Top, W4 Sides	Class D
Buried walls and footing walls, (Interior)	W1	Class A
	W1	Class B
Buried walls and footing walls, (Exterior)	W1	Class C
	W1	Class D
Exposed walls	S2 Top, W4 Sides	Class C
	S2 Top, W4 Sides	Class D
Slabs and floors,	S4	Class C
(Exterior)	S4	Class D
Slabs and floors,	S2	Class A
(Interior)	S2	Class B
Equipment pads and bases	S2 Top, W4 Sides	Class E (Interior)
	S2 Top, W4 Sides	Class F (Exterior)
Curbing, sidewalk, endwalls,	S4 Top, W4 Sides	Class C
staircases, driveways and ramps	S4 Top, W4 Sides	Class D
Manhole bases and benches	Special Construction	Class E
Pavement base, cradles	Special Construction	Class E
and inlet walls		Class F
Mass and fill	None	Class G
Traffic areas requiring		
early access or use	Special Construction	Class L

PART 4 MEASUREMENT AND PAYMENT

4.02 GENERAL

A. Cast-in-place concrete shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 CAST-IN-PLACE CONCRETE

A. Cast-in-Place Concrete, Lump Sum. When so provided, payment for cast-in-place concrete shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.

B. Cast-in-Place Concrete, Inclusive. When no quantity is provided, cast-in-place concrete shall be considered inclusive to payment for work associated with the related structure, utility, or improvement.

END OF SECTION

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SECTION 03 62 00
NON-SHRINK GROUTING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing a non-shrink fluid precision grout material, forming, placing and curing where shown on the contract drawings or required by equipment manufacturers, equipment bases shall be grouted in position.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specification. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 NON-SHRINK GROUTING

A. Non-shrink grouting shall be as manufactured by Master Builders, U.S. Grout Corporation, or equal.

PART 3 EXECUTION

3.01 PREPARATION AND INSTALLATION

A. Concrete foundation shall be rough and relatively level. Contractor shall remove laitance down to sound concrete and prepare concrete in accordance with manufactured recommendations.

B. Preparation of grout shall be in paddle type mortar mixer or other suitable mechanical mixer.

C. Placing of grout shall be at temperatures of 45 Degrees Fahrenheit to 75 Degrees Fahrenheit. Temperature shall be maintained above 40 Degrees Fahrenheit until strength exceeds 4000 psi.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Non-shrink grouting shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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4.02 NON-SHRINK GROUTING

A. Non-Shrink Grouting, Inclusive. When no quantity is provided, non-shrink grouting shall be considered inclusive to payment for work associated with the related equipment.

END OF SECTION

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SECTION 05 05 23
METAL FASTENINGS

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
      a. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
      b. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      c. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

1.04 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing metal fastenings as shown on the contract drawings and as required by equipment manufacturers.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Cast-in-Place Concrete - Division 03

C. Metal Fabrications - Division 05

D. Ladders - Division 05

E. Handrails and Railings - Division 05

F. Gratings - Division 05

1.06 SUBMITTALS (NONE)

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 METAL FASTENINGS

A. Stainless Steel. Metal fastenings shall be B8T, Stabilized 18 Chromium 8 Nickel conforming to the requirements of ASTM A193, furnished with brass nuts.

B. Zinc Plated Steel. Metal fastenings shall be S.A.E. Grade 5.

C. High-Strength. Metal fastenings shall be ASTM A325.

D. Standard Metal Fastenings shall be ASTM A307.

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PART 3 EXECUTION

3.02 METAL FASTENINGS

A. Stainless steel, high strength, and standard metal fastenings shall be used where shown on contract drawings, called for under Special Procedures - Division 01 and Equipment - Division 40.

B. Metal fastenings furnished by equipment manufacturers shall be installed in accordance with manufacturers recommendations.

C. Metal fastenings in contact with pressure treated wood shall be hot-dip galvanized or stainless steel (where concealed).

D. Zinc plated steel Metal Fastenings shall be installed in all other locations.

PART 4 MEASUREMENT AND PAYMENT

4.02 METAL FASTENINGS

A. General. Metal fastenings shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Metal Fastenings, Inclusive. When no quantity is provided, metal fastenings shall be considered inclusive to payment for work associated with the related equipment or construction.

END OF SECTION

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SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Cold applied asphalt bitumen dampproofing.

1.02 RELATED WORK

A. Section 31 23 23 – Backfill and Compaction.

B. Section 03 30 00 - Cast-In-Place Concrete: Concrete Substrate.

C. Section 07 21 13 - Board Insulation.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures [Submittals]: Submittal provisions.

B. Submit Product Data: Indicate properties of primer, bitumen, and mastic.

C. Submit manufacturer's installation instructions.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperatures above 40 degrees F for 24 hours before application and continuously until dampproofing has cured.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. W.R. Meadows, Inc.

B. Master Builder Solutions by BASF

C. Substitutions: per Section 01 60 00.

2.02 MATERIALS

A. Dampproofing:
   1. Sealmastic Asphalt Emulsion Dampproofing by W.R. Meadows, Inc.
   2. MasterSeal 614 by BASF.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of dampproofing.

B. Do not apply dampproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to dampproofing manufacturer.

C. Verify items which penetrate surfaces to receive dampproofing are securely installed.

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D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

B. Apply mastic to seal penetrations, small cracks, tie bar penetrations, and honeycomb in substrate.

C. Seal watertight items projecting through dampproofing surface with mastic.

3.03 APPLICATION

A. Prime surfaces in accordance with manufacturer's instructions.

B. Spray apply in accordance with manufacturer's instructions.

C. Apply two (2) coats, continuous and uniform.

D. Apply from 2 inches below finish grade elevation to top of footings. Cover wall/footing joint.

E. Backfill within time period recommended by dampproofing manufacturer.

3.04 PROTECTION

A. Protect membrane from damage.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Bituminous dampproofing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 Bituminous Dampproofing

A. Bituminous Dampproofing, Inclusive. When no quantity is provided, bituminous dampproofing shall be considered inclusive to the building foundation.

END OF SECTION

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SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Elastomeric Bituthene waterproofing membrane.

1.02 RELATED WORK

A. Section 31 23 23 – Backfill and Compaction.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 07 21 13 - Board Insulation.

1.03 SUBMITTALS

A. Submit Product Data: Indicate properties of primer, bitumen, and mastic.

B. Submit manufacturer's installation instructions.

C. Warranty.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperatures above 40 degrees F for 24 hours before application and continuously until waterproofing has cured.

1.05 QUALITY ASSURANCE

A. Membrane Manufacturer: Company specializing in waterproofing sheet membranes with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum three (3) years documented experience and approved by manufacturer.

1.06 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements [01 77 00 - Closeout Procedures]: Product warranties and product bonds.

B. Furnish five (5) year manufacturer warranty for waterproofing failing to resist penetration of water.

C. For warranty repair work, remove, and replace materials concealing waterproofing.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Grace Construction Products.

B. W.R. Meadows, Inc.

C. Carlisle.

2.02 MATERIALS

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A. Below Grade Wall Membrane Waterproofing: Bituthene 3000 or Bituthene Low Temperature Below Grade Waterproofing Membrane by Grace Construction Products.

B. Wall Membrane Primer: Bituthene Primer WP-3000 or Primer B2 by Grace Construction Products.

C. Under Floor Slab and Footing Membrane Waterproofing: Preprufe 300 R by Grace Construction Products.

D. Liquid Termination: Bituthene Liquid Membrane by Grace Construction Products.

E. Protection Board: Protection Board PB-3000 by Grace Construction Products. Rigid insulation per Section 07 21 13.

F. Adhesive: Protection Board Adhesive PBA-3000 by Grace Construction Products.

G. Termination: Polymer Batten Strip by Firestone or equal and stainless steel fasteners.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to applicator.

C. Verify items which penetrate surfaces to receive waterproofing are securely installed.

D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Apply primer as recommended by manufacturer.

3.03 APPLICATION

A. Install waterproofing system in strict accordance with manufacturer's instructions.

B. Install transitions between wall and under slab/footing waterproofing system in strict accordance with manufacturer's installation instructions.

C. Install liquid termination for wall waterproofing at locations recommended by manufacturer.

D. Terminate wall waterproofing system below grade. Apply rigid termination and fasteners at top edge of membrane.

E. Install protection board at locations not protected by rigid insulation under Section 07 21 13 - Board Insulation.

3.04 PROTECTION

A. Protect in accordance with manufacturer's instructions.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

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A. Sheet waterproofing shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 NON-SHRINK GROUTING

A. Sheet waterproofing, Inclusive. When no quantity is provided, sheet waterproofing shall be considered inclusive to payment for work associated with the related building

END OF SECTION

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SECTION 07 21 13
BOARD INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, cavity wall construction, exterior wall furring construction, and attic access construction.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Section 04 20 00 - Unit Masonry: Insulation materials for cavity wall construction.

1.03 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete: Slab and foundation construction.

B. Section 07 13 00 – Sheet Waterproofing

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) International:
1. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
2. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
3. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
4. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
5. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
7. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
8. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. International Code Council:
1. IBC - International Building Code, 2009 Edition, and referenced standards with 2011 State of Wisconsin amendments.
2. IECC - International Energy Conservation Code, 2009 Edition, and referenced standards with 2011 State of Wisconsin amendments.

C. National Fire Protection Association (NFPA):
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc. (UL):
1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Material and Equipment: Environmental conditions affecting products on site.

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

PART 2 PRODUCTS

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2.01 INSULATION MATERIALS

A. Polystyrene Insulation Type A: ASTM C578 Type IV; extruded cellular type, conforming to the following:
   1. Thermal Resistance: 5-year aged R-values of 5.4 and 5.0 minimum per inch thickness at 40°F and 75°F, respectively.
   2. Water Absorption: In accordance with ASTM C272, 0.1 percent by volume maximum.
   3. Compressive Strength: Minimum 25 psi.
   4. Flame Spread Index: Less than 75
   5. Smoke-Developed Index: Less than 450.
   6. Thickness: Thickness indicated in schedule.

B. Manufacturers:
   1. DiversiFoam Products.
   2. Dow Chemical: Styrofoam brand.
   3. Foamular.
   4. Owens Corning.

2.02 ADHESIVES

A. Adhesive: Type recommended by insulation manufacturer for application.

B. Acceptable Manufacturer's products:
   1. Henkel Loctite PL300 Foam Board Adhesive
   2. Henkel Loctite PL Premium Construction Adhesive.
   3. BASF MasterWeld 420.
   4. DAP Beats the Nail Panel and Foam Construction Adhesive.

2.03 FOAM SEALANT

A. Polyurethane insulating foam sealant; one-component, gun or straw applied; UL classified; containing no solvents, CFC's or VOC's; moisture-resistant.

B. Products:
   1. Great Stuff Pro by Dow Chemical Company.
   2. Handi-Foam by FOMO.
   3. Kwik Foam by DAP, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. 01 31 13 - Project Coordination: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

C. Verify substrate surface is flat, free of fins, irregularities, and materials or substances that may impede adhesive bond.

3.02 INSTALLATION

A. Foundation Perimeter:
   1. Adhere insulation to wall by applying 2 inch diameter spots of adhesive to insulation boards at 16 inches on center both ways.
   2. Butt edges and ends tight to adjacent board and to protrusions.
   3. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

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3.03 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Closeout Procedures: Protection of finished Work provisions.

B. Do not permit Work to be damaged prior to covering insulation.

3.04 SCHEDULES

A. Perimeter Foundation Wall Insulation: Type A, extruded polystyrene, 2-inch thick, square edges.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Board insulation shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 BOARD INSULATION

A. Board insulation, Inclusive. When no quantity is provided, board insulation shall be considered inclusive to payment for work associated with the related building.

END OF SECTION

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SECTION 07 42 44
INSULATION PROTECTION WALL PANEL

PART 1 GENERAL

1.01 WORK INCLUDED

A. Foundation insulation protection.

1.02 RELATED SECTIONS

A. Division 03 - Concrete.

B. Section 07 21 13 - Board Insulation.

1.03 ENVIRONMENTAL REQUIREMENTS

A. During installation and for not less than 48 hours before and after, ambient temperature and relative humidity shall be within limits required by type of adhesive used.

1.04 SUBMITTALS

A. Submit product data and color selection chart.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Protection Board:
   1. Material: Fiberglass reinforced plastic.
   2. Thickness: 0.050 inch nominal.
   3. Color: Neutral light/medium gray. To be confirmed with Owner during shop drawing review.
   4. Panel Height: Cover insulation without horizontal seams.
   5. Acceptable Manufacturers:
      a. Insul-Guard by DFI.
      b. Ground Breaker by Nudo, (800) 826-4132.

B. Trim:
   1. Material: Extruded vinyl.
   2. Color: Match panel color.
   3. Pieces: Cap, outside corner, inside corner, and divider.
   4. Manufacturer: by panel manufacturer.

C. Accessories:
   1. Adhesive: As recommended by manufacturer.
   2. Rivets: Nylon drive rivets, color to match panel color.

PART 3 EXECUTION

3.01 INSULATION

A. Layout panels to minimize intermediate joints.

B. Adhere the panel with adhesive to the foundation insulation as recommended by panel manufacturer.

C. Top edge of the panel shall be installed so that it will be secured behind exterior building wall cladding.

D. Rivets shall be used at the top edge of the panel where they will be concealed after installation.

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E. Attach exposed trim with rivets and concealed trim with rivets or adhesive.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Board insulation shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 INSULATION PROTECTION WALL PANEL

A. Insulation Protection Wall Panel, Inclusive. When no quantity is provided, insulation protection wall panel shall be considered inclusive to payment for work associated with the related building.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Sealant and joint backing.

1.02 RELATED SECTIONS

A. Division 03 - Concrete: Sealants used in conjunction with cast-in-place concrete.

B. Division 26 - Electrical: Sealants used in conjunction with electrical penetrations.

C. Division 40 – Process Mechanical: Sealants used in conjunction with process pipe penetrations.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) International:
   1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
   2. ASTM C1193 - Standard Guide for Use of Joint Sealants.
   3. ASTM C1382 - Test Method for Determining Tensile Adhesion Properties of Sealants When Used In Exterior Insulation and Finish Systems (EIFS) Joints.
   4. ASTM D1667 - Standard Specification for Flexible Cellular Materials – Poly (Vinyl Chloride) Foam (Closed-Cell).
   5. ASTM D1056 – Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

B. Sealing and Waterproofers Institute (SWI):
   1. SWI - Sealant and Caulking Guide Specification.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittals: Submittal provisions.

B. Product Data: Indicate sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

D. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.05 QUALITY ASSURANCE

A. Conform to Sealant and Waterproofers Institute requirements for materials.

B. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

C. Applicator qualifications:
   1. Applicator shall have at least three (3) years experience in installing materials of types specified and shall have successfully completed at least three (3) projects of similar scope and complexity.

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2. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.

D. Single source responsibility for joint sealants:
   1. Obtain joint sealants from single manufacturer for each different product required to ensure compatibility.
   2. Manufacturer shall instruct applicator in procedures for intersecting sealants.

E. Perform work in accordance with ASTM C1193 guidelines, except where more stringent requirements are indicated or specified.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements [Material and Equipment].

B. Do not install solvent curing sealants in enclosed building spaces.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 PRODUCT STORAGE AND HANDLING

A. Section 01 60 00 - Material and Equipment: Product storage and handling provisions.

B. Deliver the materials to the job site in the manufacturer's unopened containers with all labels intact and legible at time of use.

C. Store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.

1.08 SEQUENCING AND SCHEDULING

A. Section 01 31 13 - Project Coordination: Work coordination provisions.

B. Coordinate the work of this Section with all Sections referencing this Section.

1.09 SUBSTRATE CONDITIONS

A. Provide joints properly dimensioned to receive the approved sealant system.

B. Provide joint surfaces that are clean, dry, sound and free of voids, deformations, protrusions, and contaminants which may inhibit application or performance of the joint sealant.

1.10 WARRANTY

A. Deliver to the Architect signed copies of the following written warranties against adhesive and cohesive failure of the sealant and against infiltration of water and air through the sealed joint for a period of three (3) years from date of completion.
   1. Manufacturer's standard warranty covering sealant materials.
   2. Applicator's standard warranty covering workmanship.

PART 2 PRODUCTS

2.01 GENERAL

A. Compatibility:
   1. Provide joint sealants, joint fillers, and accessory joint materials that are compatible with one another and with joint substrates under project conditions.

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2. Install joint sealants, joint fillers, and related joint materials that are nonstaining to visible joint surfaces and surrounding substrate surfaces.

B. Provide colors selected by Architect from manufacturer's standard color range, unless noted otherwise.

2.02 SEALANTS

A. Polyurethane Sealant:
1. Tremco Dymonic 100, Vulkem 116, BASF MasterSeal NP2.
2. Color: Selected by Architect.
3. Locations to be used:
   a. Vertical joints which are bordered on one or both sides by a porous building material such as concrete, natural stone, or masonry or a non-porous building material such as painted metal, anodized aluminum, mill finish aluminum, stainless steel, vinyl siding, PVC, or porcelain tile.
   b. Interior and exterior door frames perimeters.
   c. Interior and exterior window and louver perimeters.
   d. Exterior concrete masonry, brick and stone joints.
   e. Exterior wall penetrations of plumbing, HVAC, and electrical items.
4. EIFS Joints: Sonneborn Sonolastic 150 with VLM Technology.

B. Self-Leveling Polyurethane Sealant:
1. BASF MasterSeal SL 1, Vulkem 45SSL, Sikaflex 1CSL.
2. For areas where the slope of the slab makes self-leveling material impractical BASF MasterSeal SL 2, Vulkem 45SSL, Sikaflex 2cNS.
3. Color: Match floor color.
4. Locations such as at interior and exterior concrete slab control and perimeter expansion joints.

2.03 ACCESSORIES

A. Primer: Non-staining type, as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, as recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Polyethylene foam rod or rope or other compatible non-waxing, non-extruding, non-staining resilient material as recommended by sealant manufacturer, closed cell, sized 25 percent wider than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 31 13 - Project Coordination: Coordination and project conditions.

B. Verify that joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

C. Beginning of installation means acceptance of substrates.

3.02 PREPARATION

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A. Prepare surfaces to receive sealants in accordance with sealant manufacturer's instructions and recommendations.

B. Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's recommendations for specified sealant.

C. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer, whether primers are required or not.
   1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
   2. Remove paints from joint surfaces except for permanent, protective coatings.
   3. Remove wax, oil, grease, dirt film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
   4. Remove loose materials and foreign matter.
   5. Remove dust by blowing clean with oil-free, compressed air.

D. Verify that joint backing and release tapes are compatible with sealant.

E. Measure joint dimensions and size materials to achieve required width/depth ratios.

F. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions, and SWI "Sealant: The Professional's Guide".

B. Where necessary to protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or caulking.
   1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
   2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

C. Provide backer rod uniformly to depth required by sealant manufacturer for proper joint design using a blunt instrument.
   1. Fit securely by compressing backer material 25 percent to 50 percent so no displacement occurs during tooling.
   2. Avoid stretching or twisting joint backer.
   3. Install to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where backer rod is not used or where recommended by sealant manufacturer, adhering strictly to the manufacturers installation requirements.

E. Prime joint substrates where required.
   1. Use and apply primer according to sealant manufacturers recommendations.
   2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.
   3. Prime immediately prior to caulking.

F. Install sealants immediately after joint preparation.

G. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles, and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.

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H. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

I. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.

J. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

K. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities. Provide concave tooled joints.

L. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.

M. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove, and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of substantial completion.

N. Clean adjacent surfaces immediately and leave work neat and clean. Remove excess and droppings using recommended cleaners as work progresses. Remove masking tape immediately after tooling of joints.

3.04 CLEANING AND REPAIRING

A. Section 01 77 00 - Closeout Procedures: Cleaning provisions.

B. Clean adjacent soiled surfaces.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Section 01 77 00 - Closeout Procedures: Protecting installed work.

B. Protect sealants until cured.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Joint sealants shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 JOINT SEALANTS

A. Joint Sealants, Inclusive. When no quantity is provided, fluid applied waterproofing shall be considered inclusive to payment for work associated with the related equipment.

END OF SECTION

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SECTION 09 96 00
HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto. Current edition, unless noted otherwise.

1. American Concrete Institute
   a. ACI 347 – Guide to Formwork in Concrete
2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
   a. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer and Related Products.
3. International Concrete Repair Institute (ICRI):
   a. ICRI Technical Guideline 310.2R – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair
4. Steel Structures Painting Council (SSPC), Specification and Standards:
   a. Steel Structures Painting Manual, Volume 2, “Systems & Specifications”, Current Edition.
   b. SSPC Guide 23, Field Methods For The Determination Of Moisture In Concrete and Masonry Walls and Ceilings
   c. SSPC-TR 3/NACE 6A192 – Dehumidification, Temperature Control, Surface Preparation
   d. SSPC-TR 2/NACE 6G198 – Wet Abrasive Blast Cleaning
   e. SSPC-TR 1/NACE 6G194 – Thermal Pre-Cleaning
   f. SSPC-SP WJ-4/NACE WJ-4 – Light Waterjetting
   g. SSPC-SP WJ-3/NACE WJ-3 – Thorough Waterjetting
   h. SSPC-SP WJ-2/NACE WJ-2 – Very Thorough Waterjetting
   i. SSPC-SP WJ-1/NACE WJ-1 – Waterjetting To Bare Substrate
   j. SSPC-SP 7/NACE No. 4 – Brush-Off Blast Cleaning
   k. SSPC-SP 7 (WAB)/NACE WAB-4 – Brush-Off Wet Blast Cleaning
   l. SSPC-SP 6/NACE No. 3 – Commercial Blast Cleaning
   m. SSPC-SP 6 (WAB)/NACE WAB-3 – Commercial Wet Blast Cleaning
   n. SSPC-SP 5/NACE No. 1 – White Metal Blast Cleaning
   o. SSPC-SP 5 (WAB)/NACE WAB-1 - White Metal Wet Blast Cleaning
   p. SSPC-SP 3 – Power Tool Cleaning
   q. SSPC-SP 2 – Hand Tool Cleaning
   r. SSPC-SP 16 – Brush-Off Blast Cleaning Non-Ferrous Metals
   s. SSPC-SP 15 – Commercial Power Tool Cleaning
   t. SSPC-SP 14 (WAB)/NACE WAB-8 – Industrial Wet Blast
   u. SSPC-SP 13/NACE 6 – Surface Prep of Concrete
   v. SSPC-SP 11 - Bare Metal Power Tool Cleaning
   w. SSPC-SP 10/NACE No. 2 – Near-White Blast Cleaning
   x. SSPC-SP 10 (WAB)/NACE WAB-2 – Near White Wet Blast
   y. SSPC-SP 1 – Solvent Cleaning

1.03 DESCRIPTION OF WORK

A. The Contractor shall paint all surfaces required as indicated on the contract drawings and as specified herein. The work includes painting and finishing items and surfaces and preparation of surfaces to receive coatings throughout the project as shown on the drawings and in the Painting Schedule in this section, or by direction of the Engineer.

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B. Paint all surfaces exposed to view whether or not colors are designated in Painting Schedule, except where the natural finish of the material is obviously intended or specifically noted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.

C. The work includes field painting of all exposed structural steel, bare and covered pipes and ducts (including color coding), hangers, exposed ferrous metal work and primed metal surfaces of equipment.

D. Unless otherwise specified, shop primer coats are included under the various sections for structural steel, miscellaneous metal, hollow metal work, architectural woodwork, and shop-fabricated or factory-built mechanical and electrical equipment, and similar items, and are not included herein.

E. Unless otherwise indicated, the Contractor need not paint factory-finished or pre-finished items such as, but not limited to, equipment with factory-applied finish, acoustic materials, architectural woodwork, finished electrical equipment including light fixtures, switch gear and power distribution panels, decorative masonry units, or process piping with exterior bituminous based coating.

F. All process equipment, such as pumps and blowers, shall be painted the color indicated in the Color Schedule found elsewhere in this section.

G. Unless otherwise directed, painting is not required on surfaces such as walls or ceilings in concealed areas and inaccessible areas (i.e., foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and crawl space walls).

H. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, except as otherwise directed.

I. The Contractor shall not paint any moving parts of operating units, slide and bearing surfaces, mechanical and electrical parts such as valve and damper operators, linkages, sending devices, motor and fan shafts, unless otherwise directed.

J. The Contractor shall not paint over any required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

K. Contractor shall paint existing surfaces damaged by construction activities and surfaces to receive work. Surface preparation and painting system shall be as scheduled in this section. Color shall be selected by Owner from samples submitted by Contractor to as closely as possible match existing surfaces.

L. Examine specifications and drawings of all other trades and become thoroughly familiar with provisions regarding their painting.

1.04 WORK NOT INCLUDED

A. Shop Priming: Unless otherwise specified, shop primer coats are included under the various sections for structural steel, miscellaneous metal, hollow metal work, architectural woodwork, and shop-fabricated or factory-built mechanical and electrical equipment, and similar items.

B. Pre-Finished Items: Unless otherwise indicated, do not paint factory-finished or pre-finished items such as (but not limited to) metal toilet enclosures, acoustic materials, architectural woodwork, finished mechanical and electrical equipment including light fixtures, switch gear and power distribution cabinets, decorative masonry units or process piping with exterior bituminous coating. All process equipment, such as pumps and blowers, shall be painted the color indicated in the Color Schedule found elsewhere in this section.

C. Concealed Surfaces: Unless otherwise directed, painting is not required on surfaces such as walls or ceilings in concealed areas and inaccessible areas (i.e., foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and crawl space walls).

D. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium (chrome) plate, and similar finished materials will not require finish painting, except as otherwise directed.

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E. Operating Parts: Do not paint any moving parts of operating units, slide and bearing surfaces, mechanical and electrical parts such as valve and damper operators, linkages, sending devices, motor and fan shafts, unless otherwise directed or; machined or polished surfaces of equipment where such surfaces are susceptible to rolling or sliding friction.

F. Labels: Do not paint over any required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates. (This does not include cast or embossed names on equipment castings.)

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals – Division 01

C. Concrete – Division 03 (All Sections)

D. Metals - Division 05 (All Sections)

E. Thermal and Moisture Protection - Division 07 (All Sections)

F. Finishes - Division 09 (All Sections)

G. Special Construction - Division 13 (All Sections)

H. Electrical – Division 26 (All Sections)

I. Process Integration - Division 40 (All Sections)

J. Pollution Control Equipment – Division 44 (All Sections)

1.06 DEFINITIONS

A. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, epoxies, stains, varnishes, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

B. "Immersion" service is defined as being below the elevation of the top of the wall of a structure containing liquid.

C. "High Moisture" service is defined as an area where the humidity is typically higher than surrounding areas. Surfaces to be coated with "High Moisture" service paint will be labeled as such in the Painting Schedule.

D. Bug Holes (in concrete): Surface voids, as small or irregular cavities, usually not exceeding 5/8-inch (or 15-mm) in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and consolidation. Bug holes may be considered defects if the width or depth exceeds the maximum allowable sizes as defined by ACI 301.

1.07 SUBMITTALS

A. Submit manufacturer's specifications, including label analysis and application instructions for each material specified. Furnish a complete set of color cards of proposed products to the Engineer for color selection by the Owner. The Engineer will furnish a schedule designating where various colors shall be applied.

B. Submittals for products other than those specified as the standard of quality in this specification, shall be presented ten (10) days before bid date along with manufacturer's data sheets, and written performance criteria comparisons. No coating system shall be approved that changes generic type, thickness, number of coats or level of quality without written permission of the Engineer.

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1.08 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.09 DELIVERY, STORAGE, AND HANDLING

A. Material and Equipment - Division 01: Product storage and handling provisions.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in well ventilated area, unless required otherwise by manufacturer's instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Material and Equipment - Division 01: Environmental provisions.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

C. Combustion type temporary heating devices shall be vented outside of any temporary enclosure and building envelop. Combustion gases shall not be allowed in any temporary enclosure and building envelope.

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

E. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

F. Minimum Application Temperatures for Paints: 50 degrees F, unless required otherwise by manufacturer's instructions.

G. Minimum Application Temperature for Varnish and Stain Finishes: 65 degrees F, unless required otherwise by manufacturer's instructions.

1.11 QUALITY CONTROL

A. The Contractor shall submit a Quality Control Plan which identifies trained Quality Control personnel and identifies Quality Control procedures, including all tests, testing equipment, and standards, to be utilized.

B. Before proceeding with painting, finish one complete sample panel, space, room or item of each color scheme showing selected color, finish texture, and workmanship. Request review and approval by the Engineer of first finished sample panel, space, room or item. Use first acceptable sample panel, space, room or item as the standard for similar work throughout.
   1. Approved samples will be kept on job for comparison;
   2. Engineer reserves right to select unopened containers of materials furnished on job and have materials tested at an approved laboratory;
   3. Owner will pay for first tests. Retests of rejected materials and tests of replacement materials shall be paid for by Contractor. Remainder of contents of containers not required for testing will be returned to Contractor.

C. Include on label of each container:
   1. Manufacturer’s Name and Type of Material

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2. Federal Specification Number, if applicable
3. Manufacturer's Stock Number and Batch Number
4. Contents by Volume of Major Pigment and Vehicle Constituents
5. Thinning Instructions
6. Application Instructions
7. Color

1.12 REGULATORY REQUIREMENTS

A. Conform to Uniform Building Code (UBC) and Building Officials Conference of America (BOCA) for flame/fuel/smoke rating requirements for finishes as these references are applicable to materials and workmanship under this Contract.

1.13 CLOSEOUT SUBMITTALS

A. Closeout Procedures - Division 01: Project closeout provisions.

1.14 EXTRA MATERIAL

A. Closeout Procedures - Division 01: Extra material provisions.

B. Provide a one (1) gallon container of each color, type, and finish to Owner for paint for walls and ceilings.

C. Provide one (1) quart container of each color, type, and finish to Owner for all other paint.

D. Label each container with color, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS AND MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. The products listed are intended to establish a basis for comparison of products of other manufacturers. Substitutions shall comply with the requirements of the General & Supplementary Conditions and as specified herein.

B. All materials specified herein, and approved for use under this Contract shall be manufactured by one of the Manufacturers listed as follows: Tnemec, Sherwin-Williams, or equal.

2.02 MATERIALS

A. Provide the best grade (quality) of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable. Refer to the Painting Schedule in this section for the types of paint and finishes to be applied to the various surfaces throughout the project.

B. Use only thinners recommended by the manufacturer and then only to the extent expressed on the latest printed data sheet.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND PROTECTION

A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label. Labels on each container shall include the following information:
1. Manufacturer's Name and Type of Material
2. Federal Specification Number, if applicable
3. Thinning Instructions
4. Application Instructions

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5. Clean-up Instructions
6. Color

3.02 JOB CONDITIONS

A. Environmental Requirements: Comply with manufacturer's recommendations as to environmental conditions under which coating and coating systems may be applied. Do not apply paint in areas where dust is being generated.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures to within manufacturer's approved temperature range for at least 24-hours before, during, and 48-hours after application of finishes, unless otherwise required by manufacturer instructions.

C. Protection: Cover or otherwise protect finished work, surfaces not being painted concurrently, or not to be painted.

D. Factory Painted Surfaces: The surface preparation and painting of materials and equipment shall be to manufacturer's standard, unless otherwise specified in applicable portions of these specifications.

E. Product Data Sheets (PDS) and Safety Data Sheets (SDS) for all materials shall be maintained on site at all times, along with manufacturer's technical bulletins that provide instructions for surface preparation and application.

3.03 SUBSTRATE EXAMINATION

A. Examine all surfaces to which paint is to be applied, and the conditions under which the work is to be performed. The Applicator shall notify the Contractor and Engineer in writing, of any conditions detrimental to the performance of this work.

B. All surfaces shall be a minimum of 5-degrees F. above the ambient dew point (and rising) prior to the application of any coatings.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
1. Gypsum Board: 12-percent
2. Masonry, Concrete, and Concrete Masonry Units: 12-percent
3. Wood: 15-percent (measured in accordance with ASTM D4442)

D. Test the surface of cementitious materials to verify the pH is within manufacturer's allowed range.

E. Examine cast-in-concrete surfaces for the presences of cracking. Where the type of crack is in question, moving or non-moving, consult with the Engineer prior to start of coating preparation.

F. Do not proceed with this work until unsatisfactory conditions have been corrected and are acceptable to the Applicator. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions.

3.04 TEMPORARY CONSTRUCTION

A. Furnish, install and remove upon completion of painting all scaffolding, ladders or other facilities required to complete painting work.

B. Provide temporary heating and ventilating facilities as required to conform to manufacturer's environmental conditions and within confined spaces; these facilities and all other methods or equipment required to facilitate painting work or afford protection of workers or work shall be furnished, installed and removed at the completion of work as part of this contract.

3.05 SURFACE PREPARATION

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A. General:
1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, escutcheons, and similar items not to be painted, or provide surface applied protection prior to preparation and painting operations. Remove obstructions as necessary to permit complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, install the removed items by workers skilled in the trades involved.
3. Clean surfaces to be painted before applying surface treatments. Remove all oil, grease, and foreign contaminants to meet the requirements of SSPC-SP1 prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces.

B. Uncoated Steel and Iron:
1. Pre-Clean all surfaces per SSPC-SP1 to remove all oil, grease and all other foreign contaminants with a cleaner/solvent recommended by the coating manufacturer.
2. Pre-Clean all surfaces to SSPC-SP1 followed by a minimum combination of SSPC-SP2 Hand Tool Cleaning/ SSPC- SP3 Power Tool Cleaning.
3. Prepare steel substrates in accordance with the Steel Structures Painting Council surface preparation number indicated in the application schedule and as outlined below, unless otherwise required by the paint manufacturer's most recent printed application instructions:
    a. SSPC-SP-1: thoroughly wipe with appropriate solvent using clean rags and solvent
    b. SSPC-SP-6/NACE 3: "Commercial Abrasive Blast
    c. SSPC-SP-6/NACE 3: surface Brush Blast using fine sand or grit to obtain finish similar to medium sand paper
    d. SSPC-SP-10: surface blast to Near-White Metal Finish
4. Prior to the application of prime coats, the surface shall meet the specified surface preparation standard. Clean and touch-up shop primer that has become marred.
5. Provide dehumidification equipment as necessary to maintain relative humidity at 40% or less.

C. Shop Primed Steel Surfaces
1. Pre-Clean all surfaces to SSPC-SP1 followed by a minimum combination of SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning, to remove all oil, grease and all other foreign contaminants with a cleaner/solvent recommended by the coating manufacturer.
2. Touch-up paint structural steel, miscellaneous metal, hollow metal doors and frames and other materials which have been prime coated, as required, where shop coat has been damaged by welding or handling and erection; paint rivets, bolts and welds which are unpainted after assembly and erection.

D. Galvanized Steel
1. Pre-Clean all surfaces per SSPC-SP1 to remove all oil, grease and all other foreign contaminants with a cleaner/solvent recommended by the coating manufacturer.

E. Hot-Dipped Galvanized (HDG) Surfaces:
1. HDG metal, which has not been weathered in an exterior environment for a minimum of 6 months and will be in an exterior exposure with a benign atmospheric exposure, shall be either abrading or etching using an approved etching cleaner.
2. HDG metal, which has weathered in exterior exposure for a minimum of 6 months, shall be cleaning as per SSPC-SP1.
3. HDG metal in a hazardous environments shall be prepared to SSPC-SP16 Brush Blasting Standards.
4. HDG hollow metal doors or decking shall be cleaned by a solvent wipe or power-washed.
5. HDG metal (shiny galvanized metal): the surface shall be cleaned with a water based degreasing agent or the appropriate solvent cleaner prior to application of primers and coatings or be prepared to SSPC-SP16 standards.
6. Touch-up galvanized coating where scratched or damaged with an approved 100-percent solids zinc-rich galvanizing paint.

F. Aluminum and Stainless Steel

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1. Clean to remove surface contamination by steam or high-pressure water.
2. Remove oxidation with acid etch and solvent washing.
3. Apply etching primer immediately following cleaning.

G. Copper
1. Clean to remove surface contamination by steam, high-pressure water, or solvent washing.
2. Apply vinyl etch primer immediately following cleaning.

H. Cementitious Materials
1. Pre-clean all surface to remove all oil, grease, efflorescence and other foreign contaminants
2. Preparing surface to SSPC-SP13/NACE 6 Concrete Surface preparation Standards.
3. Surface profile of surfaces to be painted shall be based on manufacturer's instructions and ICRI Guideline 310.2R Standards.
4. The pH of the concrete shall be a minimum of 10 prior to the application of repair products, primers or coatings.
5. Where the surface test for pH indicates surfaces are not within allowable range by the paint manufacturer, apply appropriate Alkali Resistant Primer per manufacturer's instructions.
6. Cementitious Materials (mortar, concrete, etc.) shall be cured a minimum of 28 days prior to the application of primers, paints and coatings.
7. Fill all voids, bug holes, non-moving cracks, and other surface defects using an approved cementitious mortar or epoxy filling compound per manufacturer's instructions to provide uniform surface texture prior to application of block filler or primer.
8. Apply block filler to surface of concrete masonry units, precast-concrete plank, and cast-in-place concrete to achieve a pinhole free surface prior to application of top coats.

I. Gypsum Board
1. Latex fill minor defects. Sand smooth and do not raise nap of paper on wallboard. Spot prime defects after repair.

J. Wood
1. Clean wood surfaces to be painted of all dirt, soil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required.
   a. Sandpaper smooth those finished surfaces exposed to view, and dust off;
   b. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other approved sealer, before application of the priming coat;
   c. Apply knot sealer to all pitch pockets and resinous sapwood before priming coat is applied;
2. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

K. Asphalt or Bituminous
1. Clean to remove foreign particles.

L. Insulated Coverings
1. Clean to remove dirt, grease, and oil from canvas and cotton.

M. Miscellaneous
1. Preparation for other materials not previously listed shall be as required by product manufacturer.

3.06 MATERIAL PREPARATION

A. Mix and prepare painting materials in accordance with the manufacturer's directions. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and, if necessary, strain the material before using.

3.07 COLORS

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A. For estimating purposes, bidder shall assume that each individual room shall have one wall color and a second color for trim and accents. Ceilings may be painted different color than walls.

B. Access doors shall be enameled to contrast adjacent wall surfaces. Steel door lintels shall be painted to match door frames.

C. Hollow metal work will generally be enameled same color, but different color than adjacent walls.

D. Exposed piping and ducts generally (except for identification banding) will be painted color and texture to match adjacent walls, or ceilings.

E. Intermediate coats of paint shall be tinted slightly darker than each preceding coat unless otherwise directed. Undercoats shall be tinted slightly lighter than finish coats.

3.08 APPLICATION

A. Contractor and applicator shall ensure the proper Dry Film Thickness is achieved in all paint/coating applications to satisfy the specification requirements and manufacturers recommendations, and as per Best Industry Standards.

B. It is the responsibility of the contractor to have the necessary calibrated dry film thickness gauges and wet film thickness gauges to ensure proper application.

C. All surfaces to be painted or coated shall be a minimum temperature of 5 degrees F above the dew point (and rising prior) to application of any primers, paints or coatings. Follow instructions and recommendations provided on the manufacturer product data sheets regarding temperature, relative humidity and other environmental factors.

D. Brush or roll materials smoothly in solid, even colors without drops, runs, lumps, defective brushing, discoloration or clogging of lines and angles. Make edges of paint adjoining other materials or colors sharp and clean without overlapping by masking edges of paint adjoining other materials or colors to obtain sharp, clean division.

E. Follow Manufacturer Instructions provided on the Product Data Sheets regarding re-coat windows and cure times.

F. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, will be allowed; thin paint in strict accordance with the manufacturer's instructions and only with the full knowledge and approval of the Engineer.

G. Do not apply finish coats until after other trades, whose operations would be detrimental to finish painting, have completed work in the areas to be painted, and the areas have been approved by the Engineer for painting.

H. Touch up suction spots or "hot spots" in masonry or concrete after application of first coat and before applying second coat, to produce even result in finish coat. If undercoats, stains or other conditions show through the final coat of paint, apply additional coats until the paint film is of uniform finish, color and appearance.

I. Woodwork and doors shall be finished on all edges, tops and bottoms in same manner as specified for faces.

J. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.

K. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.

L. Paint the backsides of access panels, and removable or hinged covers to match the exposed surfaces.

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M. Exposed conduit, ductwork, and piping shall be painted to match background color, unless noted otherwise.

N. At completion, touch up and restore finish where damaged. Paint top and bottom edges of metal doors one coat.

3.09 FIELD QUALITY CONTROL

1. Contractor shall maintain a Quality Control Plan which documents and records the following information. This information shall be collected on a form and maintained on the job site for each day of work performed by the Contractor.
   a. Record of the following environmental conditions a minimum of four (4) times daily, prior to commencing work, post morning break, post lunch break, and post afternoon break:
      1) General weather conditions
      2) Air temperature
      3) Surface temperature
      4) Dew point
      5) Relative humidity
   b. Area of work completed each day
   c. Product and manufacturer information, batch numbers, and quantities of all material used on site each day
   d. Date and time of initiation and completion of surface preparation
   e. Date and time that materials were mixed and applied
   f. Details on surface preparation equipment and coating equipment used each day
2. Contractor to perform the quality control procedures listed below in conjunction with the requirements of this Section:
   a. Inspect all materials upon receipt to ensure that all are supplied by the approved Manufacturer.
   b. Provide specified storage conditions for the coating materials and applicable solvents.
   c. Inspect and record findings for the degree of cleanliness of substrates used.
   d. Inspect and record substrate profile.
   e. Measure and record ambient air temperature using a thermometer and measure and record substrate temperature using an infrared or other surface thermometer.
   f. Measure and record relative humidity and dew point temperature using a sling psychrometer in accordance with ASTM E337.
   g. Provide correct mixing of coating materials in accordance with the Manufacturer's instructions.
   h. Inspect and record that the "pot life" of coating materials is not exceeded during installation.
   i. Verify curing of the coating materials in accordance with the Manufacturer's instructions.
   j. Upon completion of the coating system, the area shall be cleaned and prepared to permit close visual inspection by the Engineer or the Engineer's representative. Any and all deficiencies or defective work (not in compliance with this section or related sections) will be marked for repair or removal/replacement by the Contractor at no additional cost to the Owner.

B. Acceptance Criteria

1. Acceptance Criteria for Surface Preparation Work:
   a. All surfaces shall be prepared in accordance with the specification and referenced standards therein.
2. Acceptance Criteria for Coating System Application Work:
   a. Acceptable coating work will be based upon the following:
      1) No pock-marks, depressions, waviness or ridges, pinholes or holidays in either size or frequency.
      2) No intercoat bond failures between lifts.
      3) Proper curing of coatings.
   b. The Engineer or Engineer's Representative shall, at their discretion, inspect the following:
      1) Profile and degree of cleanliness of substrate.
      2) Thickness of materials/coverage rate confirmation.
      3) Ambient temperature and humidity requirements and substrate temperature.

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4) Curing and recoat times.
5) Proper curing of the resurfacing materials.

c. Rework required on any holidays or any other inadequacies found by the Engineer or the Engineer's Representative in the quality of the coating work shall be marked. Such areas shall be re-cleaned and reworked by the Contractor according to these specifications and the Manufacturer recommendations at no additional cost to the Owner.

d. The Contractor is responsible for keeping the Engineer informed of all progress so that inspection for quality can be achieved.

e. The Contractor is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the Engineer or the Engineer's Representative do not limit this responsibility.

C. Final Inspection

1. Perform a final inspection to determine whether the resurfacing system work meets the requirements of the specifications. The Engineer and the Engineer's Representative will conduct final inspection with the Contractor.
   a.

3.10 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damages by cleaning, repairing or replacing, and repainting, as directed by the Engineer. Provide “Wet Paint” signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.11 CLEAN-UP

A. During the progress of the work, remove from the project all discarded paint materials, rubbish, cans and rags. Upon completion of painting work, clean all window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.12 PAINTING SCHEDULE

A. Provide the following finish painting systems for the various substrates as shown on the contract drawings and/or schedules and as specified herein.

1. Submit Painting Schedule to Engineer for color selection by Owner (see following for schedules);
2. Apply paints to surfaces in accordance with the schedule;
3. If surfaces have been primed at the mill, factory or shop, omit the surfacer coat specified hereinafter, except for touch-up; for touch-up, use surfacer of the same composition as the mill, factory or shop surfacer.

B. Substrates of “New or Previously Unpainted Surfaces” shall be defined and coated by painting systems scheduled as follows:

Substrate		System
1.	Concrete and Masonry (cementitious materials):	
a.	Block Masonry, Exterior	A
b.	Block Masonry, Interior	B
c.	Concrete Walls, Interior	C
d.	Concrete Floors, Interior	D
e.	Concrete Ceilings, Interior	E
f.	Poured Concrete, Exterior	F
2.	Metals:	
a.	Metal Building Accessories, Interior	G
b.	Building Accessories, Exterior	H
c.	Galvanized Metals, Interior, Non-Immersion	I
d.	Galvanized Metals, Exterior, Non-Immersion	J

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e.	Galvanized Metals, Exterior, Immersion	K
f.	Ferrous Metals, Interior and Exterior, Immersion	L
g.	Ferrous Metals, Interior, Non-Immersion	M
h.	Ferrous Metals, Exterior, Non-Immersion	N
i.	Mill, Factory Paint Piping, Equipment and Machinery, Interior and Exterior	O
j.	Mill Finish Aluminum	P
3. Gypsum Board:		Q
4. Plumbing and Miscellaneous:		
a.	Plumbing - PVC and HDPE	R
5. Wood:		
a.	Wood, Interior and Exterior	U

3.13 PAINTING SYSTEMS

A. Where more than one manufacturer is listed, it is the contractor's option to select from the list. A single manufacturer shall be used for each item.

B. All products shall be installed per manufacturer printed instructions.

C. Where no thickness is listed for a coat, install to thickness recommended by manufacturer.

D. Each coat shall be applied to an even finish. Apply next coat per manufacturer instructions for recoating time.

E. System A: Block Masonry, Exterior
1. Surface Preparation: Clean and dry and joints cured. Remove excess mortar and mortar smears.
2. Surfacer: One (1) coat Block Filler Epoxy, applied by spray and back roll technique to fill voids for even, pinhole free final finish.
   a. Tnemec Series 69
   b. Sherwin Williams Heavy Duty Block Filler
   c. or equal
3. Surfacer: One coat Acrylic Emulsion.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
4. Finish: Apply one (1) or two (2) topcoat(s) to provide an even pinhole free finish.
   a. Tnemec Series 73
   b. Sherwin-Williams Acrolon 218
   c. or equal

F. System B: Block Masonry, Interior
1. Surface Preparation: Clean and dry and joints cured.
2. Surfacer: One (1) coat Block Filler Epoxy, applied by spray and backroller application, to fill voids as needed to provide an even, pinhole free final finish.
   a. Tnemec Series 69
   b. Sherwin Williams Heavy Duty Block Filler
   c. or equal
3. Intermediate: One (1) coat Polyamidoamine Epoxy, applied by spray and backroller application.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
4. Finish: One (1) coat Polyamidoamine Epoxy, applied by spray and backroller application.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal

G. System C: Concrete Walls, Interior

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1. Surface Preparation: Per the requirements of SSPC-SP13/NACE 6 and the surface profile requirements of ICRI Guideline 310.2 R and the manufacturer's instructions.
2. Surfacer: One (1) coat thinned by volume Polyamidoamine Epoxy, roller applied.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
3. Intermediate: One (1) coat Polyamidoamine Epoxy, roller applied, same color as surfacer, without added thinner.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
4. Finish: One (1) coat Polyamidoamine Epoxy, unthinned.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal

H. System D: Concrete Floors, Interior
1. Moisture Vapor Transmission: Perform testing per ASTM D4263 (Plastic Sheet Method) to determine if moisture vapor transmission (MVT) is occurring. If testing indicates MVT is present, perform additional testing per ASTM F1869 (Calcium Chloride Testing) or ASTM F2170 (Insitu RH Probes). Testing per ASTM F 1869 shall produce results of less than 3lbs/1000sq ft. /24 hours. Testing per ASTM F2170 shall produce results of less than 75% RH.
2. Surfacer: One (1) coat thinned by volume Polyamidoamine Epoxy, roller applied.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
3. Intermediate: One (1) coat Polyamidoamine Epoxy, roller applied.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
4. Finish: One (1) coat Polyamidoamine Epoxy.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal

I. System E: Concrete Ceilings, Interior
1. Surfacer: One coat thinned by volume per Manufacturer with Manufacturer's Thinner; Manufacturer, Color, Polyamidoamine Epoxy, applied by spray and backroller application, to manufacturer's recommended dry film thickness and per all other manufacturer's recommendations.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
2. Finish: One (1) coat Polyamidoamine Epoxy, applied by spray and backroller application.
   a. Tnemec Series 69
   b. Sherwin Williams Macropoxy 646
   c. or equal
   d.

J. System F: Poured Concrete, Exterior
1. Surface Preparation: Prepare surface per SSPC-SP13/NACE #6, to surface profile specified in ICRI Guideline 301.2R, and manufacturer's instructions.
2. Surfacer: One (1) coat Acrylic Emulsion, roller applied.
   a. Tnemec Series 180
   b. Sherwin Williams Conflex XL
   c. or equal
3. Finish: One (1) coat Acrylic Emulsion, roller applied.
   a. Tnemec Series 180

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b. Sherwin Williams Conflex XL
c. or equal

K. System G: Metal Building Accessories, Interior
1. Surface Preparation: SSPC-SP6 Commercial-grade blast level of cleanliness.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of not less than 4.0 mils. Primer to be shop applied for new materials; field applied for existing materials.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal
3. Shop or Field Intermediate: One (1) coat Polyamidoamine Epoxy, to an average DFT of 3.0 to 5.0 mils.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal
4. Touch-up in Field:
a. Spot surface prepare by degreasing nuts and bolts and sanding and wire brushing the erection damage
b. Follow with a spot primer of Modified Polyamidoamine Epoxy primer, brush applied in two (2) coats to build a minimum of 5.0 mils over these areas.
c. Apply a final finish coat by brush, roller or spray to these areas only to the extent of 3.0 mils DFT.
5. Finish: One (1) coat Modified Polyamidoamine Epoxy, to an average DFT of 2.0 to 3.0 mils.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal

L. System H: Metal Building Accessories, Exterior
1. Surface Preparation: SSPC-SP6 Commercial-grade blast level of cleanliness.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of not less than 4.0 mils. Primer to be shop applied for new materials; field applied for existing materials.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal
3. Shop or Field Intermediate: One (1) coat Polyamidoamine Epoxy, to an average DFT of 3.0 to 5.0 mils.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal
4. Touch-up in Field:
a. Spot surface prepare by degreasing nuts and bolts and sanding and wire brushing the erection damage
b. Follow with a spot primer of Modified Polyamidoamine Epoxy primer, brush applied in two (2) coats to build a minimum of 5.0 mils over these areas.
c. Apply a final finish coat by brush, roller or spray to these areas only to the extent of 3.0 mils DFT.
5. Finish: One (1) coat Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.
a. Tnemec Series 73
b. Sherwin-Williams Acrolon 218
c. or equal

M. System I: Galvanized Metals, Interior, Non-Immersion
1. Surface Preparation: Sweep-blast to roughen new spangle on the galvanized surface. Follow this with solvent cleaning to the extent of an SSPC-SP-1 level of cleanliness.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of 5.0 mils.
a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal

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3. Finish: One (1) coat Modified Polyamidoamine Epoxy, to an average DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal

N. System J: Galvanized Metals, Exterior, Non-Immersion
1. Surface Preparation: Sweep-blast to roughen new spangle on the galvanized surface. Follow this with solvent cleaning to the extent of an SSPC-SP-1 level of cleanliness.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
3. Finish: One (1) coat Polyamidoamine Epoxy, to an average DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 73
   b. Sherwin-Williams Acrolon 218
   c. or equal

O. System K: Galvanized Metals, Interior, Immersion
1. Surface Preparation: Blast to the extent of an SSPC-SP-10 near-white level of cleanliness and apply primer before any rust bloom reforms.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
3. Finish: One (1) coat Polyamidoamine Epoxy, to a DFT of 6.0 to 8.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal

P. System L: Ferrous Metals, Interior and Exterior, Immersion
1. Shop Surface Preparation: Blast to the extent of an SSPC-SP-10 near-white level of cleanliness and apply primer before any rust bloom reforms.
2. Shop Primer: One (1) coat Polyamidoamine Epoxy, spray applied to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Copoxy
   c. or equal
3. Intermediate: One (1) coat Polyamidoamine Epoxy, spray applied to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Duraplate 235
   c. or equal
4. Field Finish: One (1) coat Polyamidoamine Epoxy, spray applied to a minimum DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Duraplate 235
   c. or equal

Q. System M: Ferrous Metals, Interior, Non-Immersion
1. Surface Preparation: Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness and prime before any rust bloom reforms.
2. Shop Primer: One (1) coat Polyamidoamine Epoxy, spray applied to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Copoxy
   c. or equal
3. Intermediate: One (1) coat Polyamidoamine Epoxy, spray applied to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
4. Finish: One (1) coat Modified Polyamidoamine Epoxy, to an average DFT of 2.0 to 3.0 mils.

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a. Tnemec Series 69
b. Sherwin-Williams Macropoxy 646
c. or equal

R. System N: Ferrous Metals, Exterior, Non-Immersion
1. Surface Preparation: Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness and prime before any rust bloom reforms.
2. Shop Primer: Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Copoxy
   c. or equal
3. Intermediate: Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
4. Field Finish: One (1) coat Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 73
   b. Sherwin-Williams Acrolon 218
   c. or equal

S. System O: Mill, Factory Paint Piping, Equipment and Machinery, Interior and Exterior
1. Shop Surface Preparation: Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness and prime before any rust bloom reforms.
2. Shop Primer: Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Copoxy
   c. or equal
3. Intermediate: Spray apply one even coat of Manufacturer, Color, Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
4. Field Finish: Spray apply one field finish coat of Manufacturer, Color, Acrylic Polyurethane, to a minimum DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 73
   b. Sherwin-Williams Acrolon 218
   c. or equal

T. System P: Mill Finish Aluminum
1. Surface Preparation: Sweep-blast to roughen new spangle on the mill surface. Follow this with solvent cleaning to the extent of an SSPC-SP-1 level of cleanliness.
2. Surfacer: One (1) coat Polyamidoamine Epoxy, to a DFT of 5.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal
3. Field Finish: One (1) coat Acrylic Polyurethane, to an average DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 73
   b. Sherwin-Williams Acrolon 218
   c. or equal

U. System Q: Gypsum Board
1. Surface Preparation: Clean and dry joints cured and sanded. Blow down or sweep thoroughly, with a soft bristled brush.
2. Surfacer: One (1) coat Poly Vinyl Acrylic Sealer, roller applied.
   a. Tnemec Series 51-792

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b. Sherwin-Williams Promar 200
c. or equal

3. Finish: One (1) coat Acrylic Emulsion, roller applied.
   a. Tnemec Series 6
   b. Sherwin-Williams DTM Acrylic
   c. or equal

V. System R: Plumbing – Copper, PVC and HDPE
1. Surface Preparation: Hand sand to roughen and then solvent clean with mineral spirits to the extent of an SSPC-SP-1 level of cleanliness.
2. Field Finish(es): Two (2) thin coats Polyamidoamine Epoxy, brush, roller, or spray apply to an average DFT of 2.0 to 3.0 mils.
   a. Tnemec Series 69
   b. Sherwin-Williams Macropoxy 646
   c. or equal

W. System S: Equipment and Machinery Exhaust Piping
1. Surface Preparation: Blast to the extent of an SSPC-SP-6 Commercial-Grade level of cleanliness.
2. Field Finish(es): Brush, roller, spray apply two thin coats (2.0 to 3.0 mils DFT each) of Manufacturer, Color, Inorganic Zinc.

X. System T: Piping Insulation
1. Surface Preparation: Clean and dry. Blow down or sweep thoroughly, with a soft bristled brush.
2. Field Finish(es): Brush, roller, spray apply two thin coats (2.0 to 3.0 mils DFT each) of Manufacturer, Color, Manufacturer specified.
3. Acceptable Finish: Special per application, to be specified by manufacturer. Acceptable manufacturers include Tnemec, Sherwin-Williams, or equal.

Y. System U: Wood, Interior and Exterior
1. Surface Preparation: Sand as needed. Clean and dry. Blow down or sweep thoroughly, with a soft bristled brush.
2. Field Primer: Brush apply one even coat of Alkyd Wood Primer to a dry film thickness as recommended by the manufacturer and allow to harden before topcoating.
3. Acceptable Primer: Tnemec Series 36, Sherwin Williams Multipurpose Zero VOC, B51 Series, or equal.
4. Field Finish: Brush apply two thin coats (2.0 mils DFT each) Acrylic Emulsion.
5. Acceptable Finish: Tnemec Series 6, Sherwin Williams DTM Acrylic, or equal.

3.14 COLORS SCHEDULE

A. Colors for any components not specifically mentioned herein shall be selected by the Owner; submit Color Schedule to Engineer.

B. Paint for components listed shall be of the colors scheduled as follows:

COMPONENT	COLOR
1. Potable Water Piping (Boosted)	Blue
2. Potable Water Piping (Suction)	Light Blue
3. Non-Potable Water Piping	Light Green
4. Gas Piping, Natural	Yellow
5. Sewage Piping	Gray
6. Chemical Piping	Orange with Red Bands
7. Equipment and Tanks	Match Attached Piping
8. Miscellaneous Metals	Selected by Engineer
9. Heat Ducts and Grilles	Match Background
10. Electrical Conduit	Match Background
11. Domestic Drainage/Vent	Black

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12. Other Lines Selected by Engineer

Note: Color coded bands will be placed every 30-inches along the axis of the piping.

PART 4 MEASUREMENT AND PAYMENT

4.01 HIGH PERFORMANCE COATINGS

A. General. High performance coatings shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. High Performance Coatings, Lump Sum. When so provided, payment for high performance coatings shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. High Performance Coatings, Inclusive. When no quantity is provided, high performance coatings shall be considered inclusive to payment for work associated with the related construction.

END OF SECTION

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SECTION 13 34 30
FABRICATED ENGINEERED STRUCTURE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. Aluminum Association (AA), Aluminum Construction Manual, Specifications for Aluminum Structures, Current Edition.
   2. American Concrete Institute (ACI) Annual Book of ACI Standards:
      a. ACI 1
   3. Americans with Disabilities Act (ADA) of 1990, Accessibility Guidelines for Buildings and Facilities, 2010 edition.
   4. American Iron and Steel Institute (AISI), Specifications and Standards, Current Edition.
   5. American National Standards Institute (ANSI), Specifications and Standards, Current Edition.
      a. ANSI A117.1 - Accessible and Usable Buildings and Facilities, 2003.
   6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
   7. American Society of Mechanical Engineers (ASME), ASME Code, Current Edition.
   8. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
      a. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
      d. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
      e. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
      f. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
      g. ASTM C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
      h. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
      i. ASTM E2556 - Standard Specification for Vapor Permeable Flexible Sheet Water Resistive Barriers Intended for Mechanical Attachment.
   9. American Water Works Association (AWWA), Specifications and Standards, Current Edition.
   10. American Welding Society (AWS), Specifications and Standards, Current Edition.
   11. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.
   12. DSPS - Department of Safety & Professional Services, Division of Industry, Wisconsin Administrative Code
      a. Plumbing, Current Edition
      b. 2011 Wisconsin Commercial Building Code
   13. Hollow Metal Manufacturer's Association (HMMA):
      a. HMMA 810 - Hollow Metal Doors
   14. National Electric Code (NEC), Specifications and Standards, Current Edition.
   15. National Electrical Manufacturers Associations (NEMA), Specifications and Standards, Current Edition.
   16. Steel Door Institute (SDI):
      a. SDI-100 – Recommended Specifications for Standard Steel Doors and Frames.
   17. Steel Structures Painting Council (SSPC), Specifications and Standards, Current Edition.

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18. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
19. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. Furnish and install a factory designed and assembled automatic water booster station with all necessary pumps, internal valves, piping, electrical controls, and accessories. Refer to Sections 26 90 00 and 44 42 00.12.

B. Furnish and install a factory designed and assembled modular building with insulated roof, walls, floor, exterior door, plumbing fixtures, heating and ventilation, and lighting and power.

C. Factory fabricated building with electrical, plumbing, and HVAC shall be delivered to the site, set on and secured to the concrete pad, and connected to electrical and plumbing systems. Completed installation shall be complete and functional.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Cast-in-Place Concrete - Division 03

C. Joint Sealers – Division 07

D. Finishes – Division 09

E. Electrical – Division 26

F. Process Piping, Valves & Specialties – Division 40

1.05 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.06 SUBMITTALS

A. Preparation of submittals shall be in conjunction with requirements in Submittals - Division 01 of these specifications.

B. The Contractor shall submit such submittals and/or catalog cuts required for installation of the equipment. These submittals shall be accurate in every detail and shall contain all information necessary to relate the equipment to these specifications.

C. Product Data: Submit catalog cuts and descriptive information for each component.
1. Doors and frames and hardware.
2. Exterior wall veneer.
3. Roofing, soffit, fascia, etc.
4. Floor drains and cleanouts.
5. HVAC equipment and controls.
6. Dehumidifier.
7. Process pumps, valves, etc.
8. Instrumentation and control equipment components: Provide a list of all components.

D. Shop Drawings: Submit for review before panel fabrication.
1. Building Construction, including exterior veneer panels, roof construction, etc.

E. Samples:

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1. Submit color charts and samples for selection of roof and exterior cladding finishes and colors.

1.07 DELIVERY STORAGE AND HANDLING

A. The completed booster station shall be one piece when delivered and require only off loading, installation on the prescribed foundation slab, pipe line hook up and electrical service to complete the installation. Field erected buildings or buildings using steel C studs as wall framing members and C joists as roof trusses will not be acceptable.

B. A spreader bar type lifting device, built to lift the modular building from each corner of deck structure without impinging the lifting chain/cables on the modular building sidewalls or roof structure, shall be provided by the installing contractor.

1.08 QUALITY CONTROL

A. The complete unit shall be designed, fabricated, assembled and tested by the manufacturer prior to shipment.

B. The completed pump station shall be UL Listed.

C. The building and components shall be designed in accordance with the State of Wisconsin Commercial Building Code, current edition, and in compliance with design loadings as listed on the Drawings, by a State of Wisconsin licensed Professional Engineer.

1.09 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Preparation of this document shall be in conformance with the requirements stated in Submittals - Division 01 of these specifications. The Contractor shall submit to the Engineer for review an outline of any variations of information for the operation and maintenance manuals and other documentation proposed to be prepared.

B. The manuals shall include operating and maintenance literature for all components provided. The submitted literature shall be in sufficient detail to allow for the installation, operation, adjustment, calibration, maintenance and removal of each component provided.

1.10 WARRANTY

A. Fabricated Building and Systems: The manufacturer shall warranty for a period of one (1) year from the date the station is placed into operation, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the warranty period, the manufacturer will provide a replacement part without cost, upon return of the defective part.
   1. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded if they fail from normal use, not defect.

B. Wall Veneer Panels:
   1. Panels: Provide manufacturer's five (5) year warranty that exterior wall veneer panels shall to be free from defective material or workmanship for five (5) years.

C. Metal Roofing:
   1. Weathertightness: Provide manufacturer's 20-year weathertightness warranty with no repair limit liability. Warranty to include 75 MPH wind speed and to include coverage of pipe penetrations.
   2. Kynar Finish: Manufacturer's standard warranty
      a. 40 years that the system will not crack, check, or peel.
      b. 30 years that the system will not chalk or fade beyond manufacturer's defined range.
      c. 15 years that the coating will not exhibit accumulation of red rust beyond manufacturer's limits.

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D. Fascia, Soffit and Trim:
   1. Provide manufacturer's limited lifetime year warranty that aluminum building products are free from manufacturing defects and will not peel, chip, crack, split, flake or blister.
   2. Provide manufacturer's standard 25-year warranty that the panels will not face or chalk beyond manufacturer's defined range.

PART 2 PRODUCTS AND MATERIALS

2.01 MANUFACTURER

A. USEMCO, Inc., Tomah, WI or approved equal.

B. Proposed equal shall be submitted to the Engineer a minimum of 10 working days prior to bid. Submittal must include data on all equipment and building components, including drawings showing the proposed station.

2.02 PUMPS, PIPING, AND SPECIALTIES

2.03 Refer to section 44 42 00.12 EQUIPMENT BASE

A. The equipment chamber's common base shall be fabricated from a minimum 3/8-inch thick structural grade steel plate, reinforced with adequate sized steel channels to prevent deflection due to equipment weight and stresses imposed from lifting and setting of equipment.

B. The underside of the station base is to be insulated with a minimum of 3-inch thick spray foam insulation. Insulation shall be installed directly under the floor plate, without air gap.

C. The steel plate and structural steel employed in the base shall meet or exceed the requirement of ASTM A36.

2.04 EQUIPMENT BUILDING

A. The booster pump station will be complete with a factory assembled modular building affixed to the steel equipment base supporting the booster pumps as shown on the plans. The completed booster station shall be one piece when delivered and require only off loading, installation on the prescribed foundation slab, pipe line hook up and electrical service to complete the installation. Field erected buildings or buildings using steel C studs as wall framing members and C joists as roof trusses will not be acceptable.

B. The Contractor is responsible for securing the pre-fabricated building to the foundation as shown on the contract drawings.
   1. The Contractor shall provide continuous angle around the full perimeter of the building flange and foundation slab interface.
   2. Refer to drawings.

2.05 BUILDING COMPONENTS

A. The polyurethane foam core shall be classified by Underwriters Laboratories as having flame spread of 25 or lower and smoke generation of less than 450 when tested in accordance with UL Standard 723 (ASTM Standard E-84).

B. All sidewall and ceiling panels shall consist of interior and exterior metal skins formed with steel dies and roll-forming equipment and checked with gauges for uniformity and accuracy. Interior of building shall be a minimum of .018" (26 ga.) thick galvanized steel panel, protected by a spray and baked white color polyester protective coating. *The use of FRP (fiberglass reinforced plastic) sheeting attached to plywood sheets as an interior finish is not acceptable*.
   1. FRP sheeting may be applied over the galvanized steel panel in chemical feed rooms only.
   2. The panel shall be furnished with an embossed finish pressed into the galvanized steel panel.

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3. Polyurethane shall be foamed-in-place (poured, not frothed) and, when completely heat-cured, shall bond to the metal skins to form a rigid 4" thick insulated panel. Overall coefficient of heat transfer ("U" factor) shall be a minimum of .033 (R-30) for 4" thick walls.
4. Wood reinforcement shall be placed inside the wall and ceiling panels where required to support the station equipment loads. Any wood reinforcement in a wall and ceiling panel shall be totally enclosed within the panel and cladded with the exterior and or interior metal skins.
5. To insure tight joints, panel edges must have foamed-in-place tongues and grooves with a flexible vinyl gasket also foamed-in-place on the interior and exterior of all tongue edges.
6. Panels shall be equipped with cam lock joining devices.
    a. The distance between locks shall not exceed 46".
    b. Each locking device shall consist of a cam-action, hooked locking arm placed in one panel, and a steel rod positioned in the adjoining panel, so that when the locking arm is rotated, the hook engages over the rod and draws the panel tightly together with cam action.
    c. The locking arms and steel rods shall be housed in individual steel pockets set into the panel. Press fit caps shall be provided to close lock wrench holes.
    d. A cam lock wrench shall be supplied with the building.

C. Exterior of building shall be a minimum of .018" (26 ga.) thick galvanized steel panel. The building exterior shall be covered with panels that have natural aggregate embedded in a reinforced polymer to produce a composite panel that is lightweight, fire resistant and durable. The panels shall be attached to wood reinforcement panels that are imbedded in the building panels.
1. The panels shall be warranted to be free from unnatural discoloration, cracking, or aggregate loss for 15 years.
2. Base bid shall be tumbled block masonry.
3. Owner to select final envelope during shop drawing review.

D. Roof System:
1. The ceiling panels shall be covered by a pitched truss roof with standing seam metal covering.
2. The roof shall be a gable end type, 3:12 minimum pitch with 12" overhang on all sides.
3. Roof peak is to run parallel to the station longest dimension. Mounting strips to be installed in modular building for mounting of the roof trusses.
4. Trusses to be spaced on a maximum of 24" centers, covered with exterior grade plywood, 30# underlayment and covered with 24 gauge steel Medallion-Lok metal panels.
5. The panels shall be as manufactured by McElroy metals. The panels shall have a factory applied Kynar 500 coating.

E. Door/Frame/Hardware:
1. Hinged entrance door shall be a steel commercial type, insulated hollow core. Matching metal jambs shall be furnished to fit prefab panels without the use of any interior framing.
2. Jamb members shall attach to panels with sheet metal screws. The door shall be supplied with weather-stripping and a wiper gasket.
3. Entrance opening shall be a minimum 36" x 78" clear opening size.
4. Hardware for doors shall be cylindrical lockset with satin stainless steel finish.
5. Each door shall have three tamper-proof pinned butt hinges.
6. All doors for outdoor structures shall be supplied with a metal shield above the door to divert rain and snow from the door opening. An extruded aluminum sillplate shall be provided on outdoor buildings.
7. Sealant:
    a. Interior and exterior perimeter of frame shall have continuous sealant.
    b. Tremco Dymeric or BASF Sonneborn NP2.
    c. Sealant color to match painted door frame color.
8. Paint:
    a. Door and frame to be painted, including top and bottom of door.
    b. Acceptable Manufacturers: DuPont, Tnemec, Carbonline, Ameron, Sherwin-Williams, or approved equal.
    c. Color to be selected by Owner.

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2.06 LIFTING DEVICE

A. A spreader bar type lifting device, built to lift the modular building from each corner of deck structure without impinging the lifting chain/cables on the modular building sidewalls, shall be provided by the installing contractor.

2.07 WELDING

A. All welding shall be in accordance with standard AWS practices, with proper fillet section and continuity to assure a sound, watertight structure. All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. Butt welds shall be used for all welded joints in line pipe assemblies. Fillet welds shall be used for flange attachment in accordance with AWWA C207.

B. All welds in contact with soil or water shall be tested with a dye penetrant to assure the watertight integrity of the weld system.

C. All pipe and fittings shall be welded by welders certified for ASME type IX pipe welding.

2.08 PROTECTIVE COATINGS

A. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by steel shotblasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding.

B. Steel and cast/ductile iron surfaces surfaces shall receive a minimum of two coats of hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products, and salt solutions. The surfaces shall receive two coats a minimum of 4 mils each to a total of 8 mils dry.

C. Piping interior shall have a fusion bonded epoxy coating applied after shotblasting. The coating shall meet AWWA C-213 standards and be applied to a minimum thickness of 12 mils.

D. Paint touch-up kits shall be provided with the station for coating areas damaged in shipping.

E. The floor in all working areas within the station shall be protected with heavy neoprene matting.

2.09 PLUMBING

A. Refer to Division 40 and Drawings for additional details and project requirements.

2.10 VENTILATION SYSTEM

A. A ventilating system shall be provided to maintain a fresh air system in the equipment chamber. The system shall be comprised of an intake louver with damper and exhaust fan with damper and exterior louver.

B. The exhaust fan shall be sized and rated to change the equipment chamber air 6 times per hour. The blower shall be of the centrifugal, squirrel cage design with statically balanced wheel to assure quiet performance and maximum air delivery.

C. Fan Certifications:
   1. The fan shall bear the AMCA Certified Ratings Seal for both sound and air performance.
   2. Fans shall be UL Listed and CSA approved.
   3. Fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.
   4. Fan shall comply with OSHA guideline 1926.300 – General Requirements for Machine Guarding.

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D. The blower shall be thermostatically controlled and shall also be provided with an automatic and a manual switch located near the door.

E. Dampers shall be insulated airfoil type of galvanized steel with seals and be provided with an actuator and be open whenever the blower is operating.

F. Louvers shall be stationary blade type of extruded aluminum and be provided exterior extended sill, interior insect screen for intake, interior bird screen for exhaust and with Kynar 500 coating on louver and sill. Color shall be selected by Owner to match or complement exterior building colors.

G. Louver Certifications:
1. Factory-assembled louver section shall be designed to withstand wind loadings of 25 PSI (100 MPH wind equivalent). Louver frames, mullions, and section joints shall be adequately supported from the building structure to withstand this same wind loading.
2. Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. This certified performance data shall include airflow pressure loss and water penetration.

H. Exterior perimeter of louver shall be caulked with continuous sealant. Color to match louver frame.

2.11 HEATING, VENTILATION, AND COOLING (HVAC) UNIT

A. A wall mounted, HVAC unit shall be provided by the station manufacturer.

B. The unit shall be sized to sustain the building space at or above 50-degrees Fahrenheit in New Richmond, Wisconsin. The heater package shall be factory installed.

C. Thermostats for heating and cooling controls shall be provided with the unit. The thermostat shall be mounted externally from the unit on an adjacent wall.

D. The unit shall be provided with manufacturer standard evaporator and condenser coils. The unit shall be fitted with standard control package including:
1. High Pressure Control
2. Low Pressure Control
3. Compressor Control Module

E. Sizing Requirements:
1. Nominal Capacity: 2.5 ton
2. Cooling Capacity: 29,200 BTUH
3. Heating Capacity: 28,300 BTUH
4. Basis of Design: Bard, Wall Mount, W30A2-C09
5. Filter: MERV 8 minimum
6. Electrical Data:
    a. 480VAC, three phase, 60 Hz
    b. Minimum Circuit Ampacity: 16A
    c. Maximum external circuit breaker: 20A

F. Cabinet finish shall be determined by the Owner during shop drawing review. Basis of bid shall be painted steel finish from the manufacturers standard color options.

G. Certifications:
1. All electrical components shall carry UL, ETL, or CSA listing.
2. Complies with efficiency requirements of ANSI/ASHRAE/IES 90.1-2019
3. Certified to ANSI/AHRI Standard 390-2021 for Single Package Vertical Units

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2.12 DEHUMIDIFIER

A. Provide (1) high efficiency dehumidifier meeting or exceed the following requirements:
   1. Blower: 255 CFM
   2. Supply Voltage: 120V, single-phase, 60 hz
   3. Running Amps: 6.8 A
   4. Temperature Range: 33EF-110EF
   5. Dehumidifier shall be controlled by a dehumidistat with setting from 20 to 80 percent relative humidity and a positive “ON” and “OFF” setting.
   6. Dehumidifier shall have a blower switch that permits continuous blower operation independent of dehumidification.
   7. Provide manufacturer’s warranty for a minimum of 5 years.
   8. Dehumidifier shall be Hi-E Dry Model 100, as manufactured by Therma-Stor Products, or equal.

2.13 ELECTRICAL CONTROL SYSTEM

A. Refer to Division 26 for project requirements.

B. Refer to the Drawings for additional details.

2.14 PANEL MOUNT LOAD CENTER

A. Refer to Division 26 for project requirements.

B. Refer to the Drawings for additional details.

2.15 LIGHTING PANEL TRANSFORMER

A. Refer to Division 26 for project requirements.

B. Refer to the Drawings for additional details.

2.16 WIRING

A. Refer to Division 26 for project requirements.

B. Refer to the Drawings for additional details.

2.17 LIGHTS

A. Refer to Division 26 for project requirements.

B. Refer to the Drawings for additional details.

2.18 PREFABRICATED BOOSTER PUMP SYSTEM

A. Refer to Sections 44 42 00.10, and the drawings for mechanical equipment and components.

2.19 PROCESS PIPING AND ACCESSORIES

A. Refer to Section 40 23 23, and the drawings for mechanical piping and accessories.

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PART 3 CONSTRUCTION METHODS

3.01 INSPECTION AND TEST

A. Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

3.02 EQUIPMENT START-UP

A. After the job installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Four (4) copies of O and M manuals will be supplied to the owner prior to initial operation.

B. A written report covering the representative's activities and installation approval shall be submitted to the Engineer. This report shall cover all inspections and outline in detail any deficiencies in the installation.

PART 4 MEASUREMENT AND PAYMENT

4.01 ABOVE GROUND BOOSTER STATION

A. General. ABOVE GROUND PUMPING STATION shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

1. ABOVE GROUND BOOSTER STATION, Lump Sum. When so provided, payment for ABOVE GROUND BOOSTER STATION shall be made at the contract lump sum price bid or as specified in Special Conditions - Division 01.

END OF SECTION

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SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable electrical systems as indicated on the drawings and as specified herein

B. Design Requirements:
   1. The table included in this section under Hardware Design Requirements specifies the usage requirements for the hardware and equipment specified in the following sections:
      a. Section 26 05 29 Hangars and Supports for Electrical Systems
      b. Section 26 05 34 Conduit for Electrical Systems.
      c. Section 26 05 35 Boxes for Electrical Systems.

C. Electrical Work Specified Elsewhere:
   1. Every attempt has been made to indicate in these specifications and drawings all work required under Division 26. However, there may be additional specific requirements in the specifications, drawings, or addenda of other trades which pertain to the work of this trade, and any such requirements are hereby made a part of the requirements for this trade.

D. Design Intent:
   1. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
   2. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or Drawings, the Contractor shall furnish the item, system, or workmanship that is the highest quality, largest, or most closely fits the design intent.
   3. Refer to the General Conditions of the Contract for further clarification of Design Intent.
   4. The details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.
   5. All sizes as given are minimum except as noted.
   6. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to inspections, tests and approval from the commencement until the acceptance of the completed work.
   7. Electrical requirements for equipment are based on design data. It shall be the responsibility of the Contractor to verify actual requirements with the provider of the equipment and adjust electrical installation based upon actual requirements.

E. Substitution of Materials:

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1. Refer to General Conditions of the Contract.
2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the specified performance from the system into which these items are placed.

F. Continuity Of Existing Services And Systems:
1. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner and the Engineer. Any outage must be scheduled when the interruption causes the least interference with normal schedules and routines. No extra costs will be paid to the Contractor for such outages that must occur outside of regular weekly working hours.
2. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

1.04 RELATED SECTIONS

A. Common Work Results for Electrical are applicable to all Division 26 sections.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submittal Requirements for Division 26 Shop Drawings:
1. Submit individual shop drawings for each section requiring submittal.
2. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
3. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered or controlled equipment.
4. Clearly notate any exceptions taken to these specifications.
5. Do not release equipment for construction until submittal has been reviewed.
6. Failure to comply with these requirements does not relieve the Contractor of responsibility for meeting the project schedule.

C. Review of shop drawings constitutes acceptance of general design only and will not release the Contractor for fulfilling the terms and intent of the contract documents.

D. Costs of Review of Shop Drawing Submittals. The Owner shall be responsible for the cost of Engineer's review of shop drawing submittals. However, if shop drawings for any individual part of the work are rejected or returned to the Contractor for additional information, all cost for subsequent shop drawing review shall be borne by the Contractor.

E. Shop Drawings shall be prepared and submitted for the following work:
1. Lighting - See Fixture Schedule on drawings
2. Section 26 05 02 - Utility Services
3. Section 26 05 19 - Building Wire and Cable
4. Section 26 05 26 - Grounding and Bonding for Electrical Systems
5. Section 26 05 34 - Conduit for Electrical Systems
6. Section 26 05 35 - Boxes for Electrical Systems
7. Section 26 05 41 - Wiring Devices
8. Section 26 05 75 - Electrical Systems Analysis
9. Section 26 22 00 - Low Voltage Transformers
10. Section 26 24 16 - Panelboards
11. Section 26 28 19 - Enclosed Switches
12. Section 26 29 23 - Adjustable Frequency Motor Controllers
13. Section 26 32 10 - Engine Generators
14. Section 26 36 00 - Transfer Switches

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15. Section 26 90 00 - Process Instrumentation & Control

1.06 FACTORY TESTING

A. Refer to the requirements the individual technical sections.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submittal Requirements for Division 26 Operation & Maintenance Manuals and Instructions:
   1. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
      a. Copies of as-built submittals.
      b. Wiring diagrams for electrically powered or controlled equipment
      c. Records of tests performed to certify compliance with system requirements
      d. Certificates of inspection by regulatory agencies
      e. Parts lists for manufactured equipment
      f. Preventive maintenance recommendations
      g. Warranties
      h. Additional information as indicated in the technical specification sections
      i. Test Reports and Demonstration Log:
         1) Permanently record checks and tests and demonstrations.
         2) Submit copy of complete testing or demonstration report no later than 30 days after testing or demonstration is complete.

C. Operation & Maintenance Manuals and Instructions shall be prepared and submitted for the following equipment:
   1. Section 26 24 16 - Panelboards
   2. Section 26 32 10 - Engine Generators
   3. Sectio 26 36 00 - Transfer Switches
   4. Section 26 90 00 - Process Instrumentation & Control

1.08 QUALITY ASSURANCE

A. All work and materials shall conform to or exceed in every detail the applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association standards, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

B. All work shall be performed under the direction of a State of Wisconsin Licensed Master Electrician.

C. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled.

D. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
   1. Underwriters Laboratories Inc.
   2. Electrical Testing Laboratories, Inc.

E. Certificates And Inspections:
   1. Refer to the General Conditions of the Contract.

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2. Obtain and pay for all required inspections including but not limited to state or local electrical inspections and fuel tank inspections. Deliver original inspection certificates to the Engineer.

1.09 WARRANTY

1.10 EXTRA MATERIALS

A. See Division 01 for additional requirements.

1.11 DESIGN REQUIREMENTS

A. The following table specifies the usage requirements for the hardware and equipment specified in the following sections:
1. Section 26 05 29 Hangars and Supports for Electrical Systems.
2. Section 26 05 34 Conduit for Electrical Systems.
3. Section 26 05 35 Boxes for Electrical Systems.

HARDWARE USAGE REQUIREMENTS					
ATMOSPHERE	CONSTRUCTION	CONDUIT	HARD WARE	BOXES	NOTES
General, Damp, New Construction	Exposed	RMCS/RMCA	SS	NEMA 4	
General, Wet, New Construction	Exposed	RMCS/RMCA	SS	NEMA 4	2
Corrosive, Damp, New Construction	Exposed	RNC	SS	NEMA 4X	
Underground Construction	Direct Buried	RNC	N/A	N/A	1

NOTES:
1. Provide RMCS conduit for low voltage shielded wiring and Intrinsically Safe circuits.
2. Applies to all exterior above-grade conduits, except conduits in hazardous areas, and extending one foot below grade.

PART 2 PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration are sufficient; no additional access provisions are required unless specifically indicated.

B. Drywall and Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needed service; minimum size is 12 x 12 inch.

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2.02 SEALING AND FIRE-STOPPING

A. Refer to Architectural requirements.

B. Sealing and fire stopping of sleeves/openings between conduits, cable trays, wire ways, troughs, cable bus, bus duct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. Individuals skilled in such work shall perform the sealing and fire stopping.

C. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

D. Manufacturers:
   1. 3M, STI/SpecSeal, Tremco, or approved equal.
   2. The same manufacturer shall provide all fire stopping systems.
   3. The Contractor will be responsible for selecting the appropriate UL tested fire stop system for each application required on the project.

E. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

F. Contractor shall use fire stop putty, caulk sealant, intumescent wrap strips, intumescent fire stop collars, fire stop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

2.03 NON-RATED PENETRATIONS

A. Conduit Penetrations Through Below Grade Walls:
   1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.

B. Conduit and Cable Tray Penetrations:
   1. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections.

B. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

C. Identify conflicts with the work of other trades prior to installation of electrical system.

D. Electrical installation shall be based upon shop drawing requirements and field verified measurements. Adjust electrical system installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept electrical equipment on site. Inspect for damage.

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B. Protect electrical equipment from weather, corrosion, and entrance of debris.

3.03 INSTALLATION

A. Excavation And Backfill:
   1. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with other sections of this specification.

B. Concrete Work:
   1. Coordinate the quantity and location of all cast-in-place concrete work with the architectural drawings.
   2. All cast-in-place concrete will be performed by the General Contractor unless noted otherwise. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

C. Cutting And Patching:
   1. Cutting and patching shall be performed in accordance with the requirements for architectural work. Refer to other sections of these specifications.

D. Building Access:
   1. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

E. Equipment Access:
   1. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish access doors and arrange for installation bt appropriate trades.

F. Working Clearances:
   1. Minimum installed equipment working clearances as required by the NEC shall be maintained.
   2. Minimum required dedicated electrical equipment space as required by the NEC shall be maintained.
   3. Coordinate these requirements with the work of other trades.
   4. Identify conflicts with working space requirements prior to installation of equipment.

G. Coordination:
   1. Cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner. The Contractor shall check location of electrical outlets with respect to other installations before installing.
   2. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, light fixtures, panel boards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
   3. Coordinate all work prior to installation. Any installed work that is not coordinated and that interferes with the work of another trade shall be removed or relocated at no additional cost to the Owner.
   4. Verify the integrity of fire or smoke ratings where penetrations are required.

H. Sleeves:
   1. Process Equipment Areas:
      a. New poured concrete construction: cast in place, Schedule 40, PVC sleeve.
      b. All other construction: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and grout around the sleeve.

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c. Floor penetrations:
1) Extend top of sleeve two inches above the floor.
2) Where installation of sleeve in floor is not practical, provide two inch deep housekeeping pad extending three inches around cast in place conduits.

2. Non-Process Equipment Areas:
a. Hollow walls: Schedule 40, PVC sleeves, grout around sleeve in masonry construction.
b. All other Areas: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and utilize the core drilled opening as the sleeve.

3. Conduit Support:
a. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to the floor structure.

I. Sealing And Firestopping:
1. Fire and/or Smoke Penetrations:
a. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wire way, trough, etc.) penetrates a fire rated surface.
b. Where fire stop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Fire stop mortar alone is not adequate to support any substantial weight.

2. Non-Rated Surfaces:
a. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
b. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
c. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions.
d. At interior partitions, conduit penetrations are required to be sealed for all areas . Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

J. Housekeeping and Clean-up
1. On a daily basis, clean up and remove all debris and rubbish resulting from work and repair all damage to new and existing equipment resulting from work.
2. Remove all tools, excess material, and unused equipment from the site when job is complete.

K. General Inspection and Cleaning of Electrical Equipment
1. Inspect for physical damage and abnormal mechanical or electrical conditions.
2. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the Engineer. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
3. Compare equipment nameplate information with the Contract Drawings and report any discrepancies.
4. Verify proper auxiliary device operation and indicators.
5. Check tightness of accessible bolted electrical joints. Use torque wrench method.
6. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
7. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
8. Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, horizontal and vertical busducts, MCC's, control panels, and any other similar equipment
9. Clean All Equipment:
a. Loosen attached particles and vacuum them away.
b. Remove any remaining packing material adhesives with suitable cleaning solution.

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c. Touch-up factory applied finishes damaged during installation using manufacturer approved means to match original finish.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements the individual technical sections.

3.05 TRAINING

A. Refer to the requirements the individual technical sections.

PART 4 MEASUREMENT AND PAYMENT

4.01 COMMON WORK RESULTS FOR ELECTRICAL

A. Common Work Results for Electrical shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Common Work Results for Electrical, Lump Sum. When so provided, payment for Common Work Results for Electrical shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Common Work Results for Electrical, Inclusive. When no quantity is provided, Common Work Results for Electrical shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 02
UTILITY SERVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards:
      a. ANSI/NFPA 70 - National Electrical Code (NEC) and state amendments thereto, Current Edition.
   2. National Electrical Contractors Association (NECA), Standard of Installation, Current Edition.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Provide and install complete and operable utility services as required on the drawings and as specified herein.

B. Payment of Utility Company charges for service will be paid by an allowance as found in Section 01 21 00 which will be adjusted up or down by a change order to the Contract to reflect actual utility company invoices. Contractor handling charges, overhead, and mark-up shall be included in the base bid and are not included under this allowance.

C. Arrange with Electric Utility for permanent electric service for PRV Station.
   1. Electric Service:
      a. Utility Company: New Richmond Utilities.
         1) Contact person: Weston Arndt
         2) Phone number: 715-829-5505
      b. System Characteristics:
         1) Facility type: Pressure Reducing Valve Station.
         2) Required service voltage: 120/240V 1-phase, 3-wire.
         3) Required service size: 100A.

D. Arrange with Electric Utility for permanent electric service for North Booster Station.
   1. Electric Service:
      a. Utility Company: New Richmond Utilities.
         1) Contact person: Weston Arndt
         2) Phone number: 715-829-5505
      b. System Characteristics:
         1) Facility type: Booster Station.
         2) Required service voltage: 277/480V 3-phase, 4-wire.
         3) Required service size: 400A

1.04 RELATED WORK ELSEWHERE (NOT USED)

1.05 SHOP DRAWINGS

A. Submit shop drawings in accordance with the requirements of Division 01.

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B. The following information shall be submitted specifically for utility services:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Documentation required by utility company for approval.

1.06 FACTORY TESTING (NONE)

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

1.08 QUALITY ASSURANCE

A. Service entrance and metering equipment provided under this section shall be UL Listed for the service intended and shall be approved by the utility company.

B. All materials, equipment, and parts shall be new and unused of current manufacture.

C. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DIVISION OF WORK

A. The Contractor shall be responsible for coordinating conductor marking and color coding requirements with control system equipment supplier(s).

3.02 FIELD MEASUREMENTS

A. Verify existing conditions and dimensions.

B. Verify that service equipment is ready to be connected and energized.

C. Make arrangements with utility company and obtain required inspections before energizing service(s).

D. Coordinate location of utility company facilities to ensure proper access is available.

3.03 DELIVERY, STORAGE, AND HANDLING (NONE)

3.04 INSTALLATION

A. Install service entrance conduit and conductors in accordance with utility company instructions.

B. Install metering equipment in accordance with utility company instructions.

PART 4 MEASUREMENT AND PAYMENT

4.01 UTILITY SERVICES

A. Utility Services shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Utility Services, Lump Sum. When so provided, payment for utility services shall be made at the contract lump sum price bid or as specified in Special Conditions - Division 01.
   2. Utility Services, Inclusive. When no quantity is provided, utility services shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 19
BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. ASTM International, originally known as the American Society for Testing and Materials, Specifications and Standards, current edition:
      a. ASTM B800-05 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers
      b. ASTM B801-99 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
   3. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. U.L. 44 - Rubber-Insulated Wires and Cables.
      b. U.L. 50 - Enclosures for Electrical Equipment.
      c. U.L. 83 - Thermoplastic-Insulated Wires.
      d. U.L. 514B - Conduit, Tubing, and Cable Fittings.
      e. U.L. 758 - 105 degree C Appliance Wiring Materials.
      f. U.L. 854 - Service Entrance Cables.
      g. U.L. 1063 - Machine-Tool Wires and Cables.
      h. U.L. 1277 - Type TC Power and Control Tray Cables.
      i. U.L. 1569 - Metal-Clad Cables
      j. UL 1581 - Vertical Tray.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable wire and cable systems as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for wire and cable:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of wire and cable proposed.

1.05 QUALITY ASSURANCE

A. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

B. Wire and cable manufacturers shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development and production in accordance with ISO 9001.

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C. All materials, equipment, and parts shall be new and unused of current manufacture.

D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS

2.01 WIRE AND CABLE - GENERAL PURPOSE (600V, COPPER)

A. Manufacturer: Contractor option.

B. General:
1. THWN/THHN general purpose building wire insulated with polyvinyl chloride (PVC) and covered with protective sheath of nylon intended for lighting and power circuits at 600 volts or less, in residential, commercial and industrial buildings.
2. The wire shall be suitable for 90 degree C maximum continuous conductor temperature in dry locations and 75 degree C in wet locations and listed by Underwriters Laboratories for use in accordance with the National Electrical Code.

C. Conductors:
1. Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.

D. Insulation:
1. Each conductor shall be insulated with PVC and sheathed with nylon complying with the requirements of UL Standard 83 for Types THHN/THWN and UL Standard 1063 for Type MTW and CSA C22.2 No. 75 for T90 Nylon.
2. Types THWN/THHN shall comply with the optional Gasoline and Oil Resistant rating of UL Standard 83. The insulation shall also comply with UL requirements for 105 degree C Appliance Wiring Material.
3. The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL Standard 83 for Types THWN or THHN. The minimum thickness at any point, of the PVC insulation, shall be not less than 90 percent of the specified average thickness.
4. The minimum thickness at any point of the nylon sheath shall be as specified in UL Standard 83 for Types THWN or THHN.
5. The PVC insulation shall be applied tightly to the conductor and shall be free-stripping.

E. Identification:
1. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations and optional ratings. The wire shall also be identified as C(UL) Type T90 Nylon or TWN75, FT1.

F. Tests:
1. Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistant listings; as Type MTW to UL Standard 1063 (stranded items); as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN75.

G. Usage:
1. General use power wiring, minimum size No.12 AWG.
2. General use control wiring, minimum size No.14 AWG.

2.02 WIRE AND CABLE – UNDERGROUND IN CONDUIT OR DUCTBANK (600V)

A. General:
1. XHHW-2 or RHH, cross linked polyethylene insulated cables for use in circuits not exceeding 600 volts. Cables listed by UL and recognized for underground use in wet locations at a maximum continuous conductor temperature of 90ºC in accordance with Article 338 of the National Electric Code.

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2. UL listed as Type RHH or RHW-2 for general purpose wiring applications at maximum continuous conductor temperature of 90ºC in dry locations (RHH) or 90ºC in wet or dry locations (RHW-2).
3. Installed in air, conduit, or other recognized raceways in accordance with Article 310 of the National Electric Code.

B. Conductors:
1. Conductors shall be Class B stranded annealed uncoated copper per UL Standard 854 and 44.
2. A suitable separator over the conductor may be used at the option of the manufacturer.

C. Insulation:
1. Each conductor shall be insulated by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, and type designations.

D. Tests:
1. Wire shall be tested in accordance with the requirements of UL Standard 8654 for Type USE-2, UL Standard 44 for Types XHHW-2, RHW-2 or RHH.

E. Usage:
1. Underground power wiring, minimum size No. 12 AWG.

2.03 SHIELDED POWER CABLE (600V)

A. Manufacturer: Contractor option.

B. General:
1. Three conductor type TC Tray Cable insulated with cross linked polyethylene and PVC jacket overall, for use on circuits rated 600 volts and 90 degree C maximum continuous conductor temperature in wet or dry locations.
2. Cables approved for installation in cable trays in accordance with the NEC and for installation in air, in ducts or conduits, in tray or trough, in open wiring or direct buried.

C. Conductors:
1. Shall be Class B stranded uncoated soft copper.
2. Suitable separator over the conductor may be used at the option of the manufacturer.
3. Three phase conductors shall be cabled together with a Class B stranded, uncoated copper grounding conductor and suitable non-hygroscopic fillers to make round.
4. Length of lay shall not exceed 35 times the phase conductor diameter.
5. The grounding conductor shall comply with the requirements of UL Standard 1277.
6. The cable assembly shall be covered with a copper tape shield with drain wire, applied with a 10 percent minimum lap.

D. Insulation:
1. Each phase conductor shall be insulated with chemically cross linked polyethylene, meeting Type XHHW-2 requirements of Underwriters Laboratories.
2. The average thickness of insulation shall be as specified in UL Standard 44 for Type XHHW-2 conductors. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.
3. The insulated phase conductors shall be black in color and shall be printed with the numerals "1", "2", and "3" on their surface.
4. Each cable shall have a PVC protective jacket applied over the taped assembly. The jacket shall meet the Sunlight Resistant requirements of UL Standard 1277.
5. The average jacket thickness shall be in accordance with UL Standard 1277. The minimum thickness at any point shall be not less than 80 percent of the specified average thickness.

E. Identification:
1. Cables shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, voltage rating, and required UL information.

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F. Tests:
1. Individual conductors and completed cables shall be tested in accordance with UL requirements for Type TC Power Control Tray Cables having XHHW-2 conductors.
2. Cables shall be capable of passing the ribbon burner cable tray flame test requirements of UL and IEEE.

G. Usage:
1. Power wiring for motor loads controlled by adjustable frequency drives, where so indicated on the drawings.

2.04 SHIELDED INSTRUMENTATION CABLE (300V)

A. Manufacturer: CONTRACTOR option.

B. General:
1. Power limited tray cable - two conductor, No.16 AWG (7x24) bare copper, PVC insulation, overall shield with No.18 AWG (7x26) tinned copper drain wire, PVC jacket with nylon ripcord.

C. Electrical Characteristics:
1. Max. Operating voltage: 300Vrms.
2. Conductor DC resistance at 20 deg. C: 3.7 Ohms/1000 ft.
3. Shield DC resistance at 20 degrees C: 5.1 Ohms/1000 ft.
4. Capacitance between conductors at 1 kHz: 61 pF/ft.
5. Capacitance between conductor and shield at 1 kHz: 114 pF/ft.
6. Inductance: 0.19 uH/ft.

D. Physical Characteristics:
1. Temperature rating: -30 to 105 degrees C.
2. Insulation material: PVC.
3. Average insulation thickness: 0.016-in.
4. Jacket material: Sun resistant PVC.
5. Jacket thickness: 0.037-in. nominal.
6. Shield: Aluminum/Polyester, 100 percent coverage.
7. Overall lay length: 2-in. (6 twists/ft).
8. Maximum pulling tension: 94 lbs.
9. Minimum bend radius: 2.6-in.
10. Flame resistance: UL 1581 vertical tray.

E. Usage:
1. Instrumentation cable.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical system.

C. Adjust electrical system installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept electrical equipment on site. Inspect for damage.

B. Protect electrical equipment from weather, corrosion, and entrance of debris.

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3.03 INSTALLATION

A. Pre-Installation:
1. Verify that interior of building has been protected from weather.
2. Verify that mechanical work likely to damage wire has been completed.
3. Completely and thoroughly swab raceway prior to installation.
4. Verify that field measurements are as shown on drawings.
5. Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.
6. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
7. Determine required separation between cable and other work.
8. Determine cable routing to avoid interference with other work.
9. Any single conduit or raceway utilized for a feeder circuit shall contain only power conductors of a single feeder circuit. Do not combine feeder circuits without engineer's written approval.
10. Contract drawings indicate individual homerun equipment connections. Contractor may combine branch circuits of common types in single conduits provided the following conditions are met:
    a. NEC requirements for conductor de-rating are satisfied.
    b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
11. No more than eight 24VDC analog circuits may be combined in a single conduit unless specifically stated otherwise on the drawings.

B. Conductor Sizing:
1. Conductor sizes are based on copper unless otherwise noted.
2. Use conductor not smaller than No.12 AWG for power and lighting circuits.
3. Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
4. Where circuit wiring length exceeds length identified on the feeder schedule, increase wire size as needed to maintain a maximum voltage drop of three percent.
5. Use conductor not smaller than No.14 AWG for control circuits.
6. Unless shown otherwise on the contract drawings, power wiring shall be No.12 AWG.

C. Wire Pulling:
1. Pull all conductors into raceway at same time.
2. No.4 AWG and larger wire and power cables shall lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets.
3. The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.

D. Splices and Terminations:
1. Splices and terminations shall not be made within raceways.
2. Clean conductor surfaces before splicing or terminating.
3. Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.
4. Insulated spring wire connectors may be used to splice 120V power circuits.
5. Control, communication, and data transmission wire and cable shall not be spliced.
6. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
7. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
8. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

E. Motors:

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1. Motor wiring to motors less than 10 horsepower shall be spliced and terminated with fully insulated crimp-on end cap with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. “SkotchLocks” and similar devices shall not be used.
2. Motor wiring to motors 10 horsepower or larger shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. “SkotchLocks” and similar devices shall not be used.

F. Unshielded power cables:
1. Unshielded power cables shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. “SkotchLocks” and similar devices shall not be used.

3.04 TESTING AND START-UP SERVICES

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each conductor.

D. Feeder or branch circuits with ampacity greater than 100 amperes shall be tested after installation to measure insulation resistance of each conductor.

E. All equipment shall be disconnected and the wire ends shall be cleaned and dried.

F. Connect Megohmeter between conductor and a grounded point in the enclosure and energize until the reading stabilizes.

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 BUILDING WIRE AND CABLE

A. Building Wire and Cable shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
1. Building Wire and Cable, Lump Sum. When so provided, payment for Building Wire and Cable shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Building Wire and Cable, Inclusive. When no quantity is provided, Building Wire and Cable shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
      b. ANSI/NFPA 99 - Health Care Facilities.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.
   5. Institute of Electrical and Electronics Engineers (IEEE), Specifications and Standards, current edition:
      a. IEEE 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable grounding and bonding systems as indicated on the drawings and as specified herein.

1.04 RELATED SECTIONS - NOT USED

1.05 SUBMITTALS - NOT USED

1.06 FACTORY TESTING - NOT USED

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.08 QUALITY ASSURANCE

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms. Additional grounding electrodes shall be used to satisfy ground resistance requirements where required by earth conditions.

PART 2 PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 3/4-inch minimum.

C. Length: 10-feet minimum. Rod shall be driven at least 9.5-feet deep.

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D. Use one or more ground rods to obtain the minimum specified ground resistance. This applies to manholes, padmount switches, transformers, service entrances, and all other equipment requiring a supplemental grounding electrode. Minimum of three ground rods shall be used to ground the service entrance as indicated on plans.

2.02 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.03 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.04 EXOTHERMIC CONNECTIONS

A. Select the appropriate kit for specific types, sizes, and combinations of conductors and other items to be connected. Field personnel shall be trained in execution of welds.

2.05 WIRE

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Manhole and Vault Bonding: No. 4/0 minimum.

D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical system.

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C. Adjust electrical system installation to satisfy field requirements.

3.02 INSTALLATION

A. General:
1. Verify that final backfill and compaction has been completed before driving rod electrodes.
2. Install products in accordance with manufacturer instructions.
3. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
4. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
5. Attach grounds permanently before permanent building service is energized.
6. Install rod electrodes at locations indicated or as required by local code, whichever requires the most rods. Install additional rod electrodes as required to achieve specified resistance to ground.
7. Connect grounding electrode conductor and reinforcing steel in foundation footing. Bond steel together.
8. Bond all conductive components to meet Regulatory Requirements.
9. Bond together metal siding not attached to grounded structure; bond to ground.
10. All separate ground wires shall be enclosed in rigid galvanized steel conduit and bonded at both ends to the rigid galvanized steel conduit with an approved fitting.

B. Less than 600 volt system grounding:
1. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
2. Copper grounding electrode conductor shall be sized as indicated or as required by NEC, whichever is larger and shall be extended from secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Bonding jumper shall be installed around water meter. Install conductor in separate rigid conduit. Bond conduit as described above.
3. Receptacle Grounding: All receptacles installed shall have a separate grounding contact.
4. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
5. Bond together each metallic raceway, pipe, duct and other metal objects.
6. Equipment Grounding Conductor: Separate, insulated green conductor shall be installed within each raceway and cable tray, sized per NEC or as indicated in the contract documents whichever is larger. Terminate each end on suitable lug, bus, enclosure or bushing, per NEC. Install a ground wire from each device to the respective enclosure.

3.03 TESTING AND START-UP SERVICES

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.04 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Grounding and Bonding for Electrical Systems shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
1. Grounding and Bonding for Electrical Systems, Lump Sum. When so provided, payment for Grounding and Bonding for Electrical Systems shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Grounding and Bonding for Electrical Systems, Inclusive. When no quantity is provided, Grounding and Bonding for Electrical Systems shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American Iron and Steel Institute (AISI), Specifications and Standards, current edition.
   2. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   3. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
      a. ASTM A653 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
      b. ASTM A1011 - Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Ally and High-Strength Low Alloy with Improved Formability (Formerly ASTM A570).
      c. ASTM F1136 - Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners.
      d. ASTM A907 - Standard Specification for Steel, Sheet, and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled, Structural Quality.
      e. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   4. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   5. Metal Framing Manufacturers Association (MFMA), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Furnish and install supporting devices as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for supporting devices:
   1. Submit outline drawings and dimensions for equipment support racks.

1.05 QUALITY ASSURANCE

A. Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request

B. Stainless steel bolted framing parts shall be stamped to identify the material. Material certification sheets and test reports must be made available by the manufacturer upon request.

C. All materials, equipment, and parts shall be new and unused of current manufacture.

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D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

PART 2 PRODUCTS

2.01 STRUT, CHANNELS, AND CONNECTORS

A. Manufacturers:
1. Cooper B-Line, Inc.
2. or equal.

B. General:
1. Strut shall be 1-5/8-inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.

C. Materials and Finish:
1. Electro-Galvanized Steel: Strut shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 and shall be Electro-galvanized after fabrication in accordance with ASTM B633.
2. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33, and hot-dip galvanized after fabrication in accordance with ASTM A123. All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3. All hot-dip galvanized after fabrication products must be returned to point of manufacture after coating for inspection and removal of all sharp burrs.
3. Stainless Steel: All strut, fittings and hardware shall be made of AISI Type 304 stainless steel.

2.02 ANCHORS AND FASTENERS

A. Concrete and Structural Elements: Use stainless steel precast insert system, expansion anchors and preset inserts.

B. Steel Structural Elements: Use stainless steel beam clamps.

C. Concrete Surfaces: Use stainless steel self-drilling anchors and expansion anchors.

D. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.

E. Solid Masonry Walls: Use stainless steel expansion anchors and preset inserts.

F. Sheet Metal: Use stainless steel sheet metal screws.

G. Wood: Use stainless steel wood screws.

H. All other fasteners: stainless steel screws, suitable for the required usage.

2.03 HARDWARE

A. Conduit and equipment supports, clamps, and other miscellaneous materials shall be constructed of the following materials as scheduled in Section 26 05 00.
1. Steel.
2. Zinc plated steel.
3. Galvanized, malleable iron.
4. PVC coated, galvanized, malleable iron.
5. Stainless steel.
6. PVC.

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PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base locations and dimensions on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust equipment support rack installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept supporting devices on site. Inspect for damage.

B. Protect supporting devices from corrosion and damage. Do not install damaged materials.

3.03 INSTALLATION

A. General:
1. Furnish and install supports and fasteners for all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.
2. Thoroughly clean and remove construction debris from installation.

B. Strut Channel:
1. Install strut in accordance with MFMA-102 "Guidelines for the Use of Metal Framing"; in accordance with equipment manufacturer's recommendations, and with recognized industry practices.
2. Fabricate supports from channel. Rigidly weld members or use hexagon head bolts to present a neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
3. File and de-bur cut ends of galvanized support channel and spray paint with cold galvanized paint to prevent rusting.
4. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

C. Anchors and Fasteners:
1. Provide anchors, fasteners, and supports in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting".
2. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit.
3. Do not use spring steel clips and anchors.
4. Do not use powder-actuated anchors.
5. Obtain permission from Engineer before drilling or cutting structural members.
6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
7. Use channel supports to stand cabinets and panelboards 1-5/8-inch off interior or exterior surfaces of exterior walls.
8. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using anchors and fasteners.
9. Install free-standing electrical equipment on 3-inch concrete pads unless indicated otherwise on the drawings.
10. Use threaded rod, minimum size 3/8-inch, for supports where indicated on the drawings.
11. Install products in accordance with manufacturer instructions.

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PART 4 MEASUREMENT AND PAYMENT

4.01 HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS

A. Hangers and Supports for Electrical Systems shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Hangers and Supports for Electrical Systems, Lump Sum. When so provided, payment for Hangers and Supports for Electrical Systems shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Hangers and Supports for Electrical Systems, Inclusive. When no quantity is provided, Hangers and Supports for Electrical Systems shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 34
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. ANSI C80.1 - Electrical Rigid Steel Conduit (ERSC).
      b. ANSI C80.3 - Steel Electrical Metallic Tubing (EMT).
      c. ANSI C80.5 - Electrical Rigid Aluminum Conduit (ERAC).
      d. NFPA 70 - National Electrical Code.
   2. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
      a. ASTM F2160 - Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter.
      b. ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR) Based on Controlled Inside Diameter.
      c. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR) Based on Controlled Outside Diameter.
      d. ASTM D3350 - Polyethylene Plastics Pipe and Fittings Materials.
   3. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   4. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
      b. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association.
      c. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association.
      d. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association.
      e. NEMA TC 7 - Smooth Wall Coilable Polyethylene Electrical Plastic Conduit.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 1 - Standard for Flexible Metal Conduit
      b. UL 6 - Electrical Rigid Metal Conduit - Steel.
      c. UL 6A - Standard for Electrical Rigid Metal Conduit - Aluminum and Stainless Steel.
      d. UL 651A Type EB and A Rigid PVC Conduit and HDPE conduit.
      e. UL 651B Continuous Length HDPE.
      f. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit.
      g. UL 2239 - Standard for Safety for Hardware for the Support of Conduit, Tubing, and Cable.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable conduit system as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.

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1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for conduit:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of conduit and fittings proposed.

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY - NOT USED

1.09 EXTRA MATERIALS - NOT USED

PART 2 PRODUCTS

2.01 GALVANIZED RIGID METAL CONDUIT (TYPE RMCS)

A. Manufacturer: Contractor option.

B. Conduit:
   1. Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
   2. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.
   3. Top-coated with a compatible organic layer to inhibit white rust and increase corrosion resistance.
   4. Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.

C. Conduit Bodies:
   1. Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.
   2. Tapered, threaded hubs with integral bushing.
   3. Stainless steel hardware.
   4. Cover constructed of same material with solid gasket.

D. Fittings:
   1. Ferrous metal construction electro-galvanized inside and out.

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2. Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

2.02 RIGID ALUMINUM CONDUIT (TYPE RMCA)

A. Manufacturer: Contractor option.

B. Conduit:
1. Heavy wall tube manufactured of 6063 aluminum alloy in temper designation T-1 with an accurate circular cross section, a uniform wall thickness and a defect free interior surface.
2. Factory cut threads, 0.75-inch taper per foot.

C. Conduit Bodies:
1. Copper free aluminum construction coated with aluminum acrylic paint.
2. Tapered, threaded hubs with integral bushing.
3. Stainless steel hardware.
4. Cover constructed of same material with solid gasket.

D. Fittings:
1. Copper free aluminum construction.
2. Components critical to performance such as setscrews, split rings, and locknuts are adequately designed to insure positive bonds.

2.03 RIGID NON-METALLIC CONDUIT (TYPE RNC)

A. Manufacturer:
1. Carlon.
2. Champion.
3. Or equal.

B. Conduit:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-2.
3. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections, which could mar conductors or cables.
4. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
5. Schedule 80 non-metallic conduit shall be used in locations subject to physical damage. Schedule 40 non-metallic conduit may be used in all other locations.

C. Conduit Bodies:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.
3. Stainless steel hardware.
4. Cover constructed of same material with solid gasket.

D. Fittings:
1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

2.04 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (TYPE LMFC)

A. Manufacturer: CONTRACTOR option.

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B. Usage:
   1. Use in conjunction with galvanized rigid metal conduit.
   2. Use in conjunction with PVC coated galvanized rigid metal conduit.
   3. Use in conjunction with rigid aluminum conduit.

C. Conduit:
   1. Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.
   2. Jacket shall be positively locked to core to prevent sleeving.
   3. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.

D. Fittings:
   1. Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.
   2. Where used in conjunction with PVC coated galvanized rigid metal or rigid aluminum conduit connectors shall be malleable iron or steel, electro zinc plated and PVC coated, with insulated throat and taper threaded hub.
   3. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
   4. All fittings shall be liquid tight.

2.05 UNDERGROUND CONDUIT MATERIALS

A. Elbows
   1. Type RMCS; minimum bend radius of 36 inches (915 mm).
   2. Type Epoxy Fiberglass; minimum bend radius of 36 inches.

B. Conduit Termination In Manholes and Buildings
   1. Bell Ends: Manufactured bell ends of appropriate sizes at each end of conduit. When entering a new building or a new manhole a pre-manufactured PVC bell end system (as manufactured by Formex or similar) with conduit seals, provisions for roughing into the concrete and water stops is allowed
   2. Bushings: Steel grounding bushings shall be used on all metal conduit entering a building or manhole.
   3. Seals: When entering an existing building or manhole below grade, the concrete shall be core drilled for the appropriate size conduit and seal. The seal shall be a mechanical interlocking assembly of modular rubber links properly sized to fit the pipe and tightened in place, in accordance with the manufacturer's instruction.

C. Plugs
   1. Closure plugs or caps of same material as conduit on empty conduits at building entrances and at terminations in equipment pedestals to prevent the entrance of moisture and gases.

D. Pull Tape
   1. Polyester pull tape, ½" width, tensile strength of 1,250 lbs. and sequential footage markings along the entire length of the tape as manufactured by Greenlee, Carlon, Garvin Industries, or Neptco (Muletape). Install pull tape in each empty duct.

E. Grounding
   1. Steel grounding bushings shall be grounded to manhole or junction box ground.

F. Drainage Assembly
   1. All ducts shall drain to an open end - preferably a manhole.

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PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Conduit rough-in shall be based upon shop drawing requirements.

B. The Contractor shall be responsible for coordinating conduit location and rough-in with actual equipment conditions and requirements.

C. Field verify all measurements. Do not base conduit rough-in or equipment locations on the contract drawings.

D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.

E. Adjust conduit system installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris.

C. Store conduit above grade. Protect from environment with suitable covering.

D. Protect PVC conduit from sunlight.

3.03 INSTALLATION

A. General:
   1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.
   2. Arrange conduit to maintain headroom and present neat appearance.
   3. Design raceway systems to minimize the number of fittings, couplings, kicks, and offsets.
   4. Raceways located above lowest floor level:
      a. Route conduit parallel and perpendicular to walls.
      b. All raceways shall be level and straight.
      c. Vertical conduits shall be plumb.
   5. Raceways located in or under lowest level floor:
      a. Route conduit in and under slab from point-to-point.
      b. Do not cross conduits in slab.
   6. Do not use flexible conduit in place of bends, conduit bodies, or expansion fittings.
   7. Flexible conduit shall be used at all equipment terminations. Maximum length of 24-inches unless specifically allowed otherwise by Engineer based upon field conditions.
   8. Do not use cords for equipment connections unless specifically allowed otherwise by Engineer based upon field conditions.

B. Raceway sizing:
   1. Size raceways as indicated on drawings.
   2. Where raceways sizes are not indicated on drawings, size in accordance with NEC requirements. Minimum size 3/4-inch.
   3. Exposed conduit runs not longer than 10-feet in length and terminating at a single device may be 1/2-inch unless prohibited by NEC.

C. Raceway Installation:
   1. Maintain adequate clearance between conduit and piping.

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2. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
3. Cut conduit square using saw or pipe cutter; de-burr cut ends.
4. Bring conduit to shoulder of fittings; fasten securely.
5. Use conduit hubs to fasten conduit to NEMA 4X and NEMA 12 boxes.
6. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic factory elbows for bends in metal conduit larger than 2-inch size.
7. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
8. Suitable pull string shall be installed in each empty conduit, sleeves and nipples excepted.
9. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
10. Remove all debris and moisture from raceways prior to installing conductors.
11. Ground and bond conduit under provisions of Section 26 05 26.
12. Identify conduit under provisions of Section 26 05 53.
13. All field cut threads shall be coated with Thomas & Betts Kopr-Shield prior to assembly.

D. Structural Coordination:
1. Suitable fittings, designed and listed for the purpose, shall be used to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
2. Install conduit to preserve fire resistance rating of partitions and other elements.
3. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
4. Where conduit passes between areas subject to variable temperatures, seal conduits to prevent air interchange and condensation formation. Use conduit fitting specifically manufactured for this purpose.

E. Raceway Support:
1. General:
    a. Arrange supports to prevent misalignment during wiring installation.
    b. Do not permanently support conduit with wire or perforated pipe straps.
    c. Remove wire used for temporary supports.
    d. Do not attach conduit to ceiling support wires.
    e. Channel, rod, and hardware shall comply with the requirements of Section 26 05 29.
2. Hardware:
    a. Construct conduit support rack with channel and rod to support conduits not supported from structure.
    b. Support conduit with channel anchored to structure when conduit offset from structure is required.
    c. Secure conduits to channel with pipe straps.
    d. Support conduit from structure when conduit offset from structure is not required.
    e. Secure conduits directly to structure with one-hole strap and conduit spacer.

F. Conduit Separation:
1. Separate conduit systems shall be used for the following circuit categories:
    a. 120-volt power circuits.
    b. 480-volt power circuits.
    c. 24-volt control circuits.
    d. 24 VDC analog control circuits.
    e. Intrinsically safe control circuits.
    f. UTP control cables.
    g. Manufacturer supplied cables (for example, magnetic flow meter cables).
    h. Radio frequency coaxial cables (for example, antenna cables).
2. The contract drawings show individual homerun equipment connections. The Contractor may combine circuits of common types (as identified above) into single conduits provided the following conditions are met:
    a. NEC requirements for conductor de-rating are satisfied.

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b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
c. No more than eight 24VDC analog circuits are combined in a single conduit, unless specifically stated otherwise on the drawings.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 CONDUIT

A. Conduit shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
1. Conduit, Lump Sum. When so provided, payment for Conduit shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Conduit, Inclusive. When no quantity is provided, Conduit shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 35
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
      b. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
      b. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
      c. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable box systems as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for boxes:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of boxes proposed.

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

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1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes:
   1. Galvanized steel, with stamped knockouts.
   2. Gangable, suitable for number of devices shown.
   3. Suitable for flush mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.

B. Luminaire and Equipment Supporting Boxes:
   1. Rated for weight of equipment supported; include 3/8-inch male fixture studs where required.

C. Cast Boxes:
   1. Cast ferralloy or aluminum, deep type, gasketed cover, threaded hubs.
   2. Suitable for surface or flush mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.

2.02 PULL AND JUNCTION BOXES

A. General:
   1. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).
   2. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4” and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

B. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

C. Boxes Larger than 12 Inches (300 mm) in any dimension shall have a hinged cover, be rated NEMA 4X, and constructed of stainless steel.

D. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

E. Cast Metal Boxes for Underground Installations: Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Hot dipped galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws. Cover Legend: ELECTRIC.

F. Box extensions and adjacent boxes within 48” of each other are not allowed for the purpose of creating more capacity.

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G. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

H. Wireways shall not be used in lieu of junction boxes.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Box rough-in shall be based upon shop drawing requirements.

B. The Contractor shall be responsible for coordinating box location and rough-in with actual equipment conditions and requirements.

C. Field verify all measurements. Do not base box rough-in or equipment locations on the contract drawings.

D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.

E. Adjust box locations to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept boxes on site. Inspect for damage.

B. Protect boxes from corrosion and entrance of debris.

C. Store boxes above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. General:
   1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.

B. Box Installation:
   1. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
   2. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
   3. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
   4. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
   5. Use flush mounting outlet boxes in all areas.
   6. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.
   7. Use gang box where more than one device is mounted together. Do not use sectional box.
   8. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.
   9. Position outlet boxes to locate luminaires as shown on lighting plans.
   10. Adjust flush-mounting outlets to make front flush with finished wall material.
   11. Install knockout closure in unused box opening.

C. Structural Coordination:
   1. Install boxes to preserve fire resistance rating of partitions and other elements.

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2. Install flush mounting box without damaging wall insulation vapor barrier or reducing its effectiveness. Provide vapor box or vapor barrier hat for each box flush mounted in an exterior wall.
3. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
4. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

D. Box Support:
1. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
2. Use stamped steel bridges to fasten flush mounting outlet box between studs.
3. Use adjustable stainless steel channel fasteners for hung ceiling outlet box.
4. Do not fasten boxes to ceiling support wires.
5. Support boxes independently of conduit.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 BOXES

A. Conduit shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
1. Boxes, Lump Sum. When so provided, payment for Boxes shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 1.
2. Boxes, Inclusive. When no quantity is provided, Boxes shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 41
WIRING DEVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
      b. ANSI/NFPA 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
   2. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA WD 1 - General Purpose Wiring Devices.
      b. NEMA WD 6 - Wiring Device Configurations.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

1.03 DESCRIPTION OF WORK

A. Provide and install complete and operable wiring devices as required on the drawings and as specified herein.

1.04 SHOP DRAWINGS

A. Submit shop drawings in accordance with Division 01.

B. The following information shall be submitted specifically for wiring devices:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Clearly identify the types of wiring devices proposed.

1.05 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

D. Manufacturer shall specialize in manufacture of products specified in this Section with minimum three years experience.

PART 2 PRODUCTS

2.01 120V EXTRA HEAVY DUTY SPECIFICATION GRADE WALL SWITCHES

A. Single Pole Switch:
   1. 20A - Hubbell #HBL1221I.

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2. Or equal.

2.02 120V EXTRA HEAVY DUTY SPECIFICATION GRADE RECEPTACLES

A. Duplex Convenience Receptacle:
1. 20A - Hubbell #HBL5362I.
2. Or equal.

B. Simplex Receptacle
1. 20A - Hubbell #HBL5361I.

C. GFCI Duplex Receptacle:
1. 20A - Hubbell # GFR8300HILU.
2. Or equal.

D. Corrosion Resistant Simplex Receptacle:
1. 20A - Hubbell #HBL53 CM 61
2. Or equal.

2.03 WALL PLATES

A. Wall plates shall be installed as follows:
1. Use smooth stainless steel plates for receptacles and switches in sheet steel or PVC boxes.
2. Use multi-screw gasketed cast plate where cast outlet boxes are required. Covers shall not be attached by using a single screw mounting into the wiring device, but shall be attached by mounting directly to the box.
3. Use Crouse Hinds WLRS or WLRD wet location covers for receptacles identified as “WP” which are located inside structures.
4. Use aluminum or cast metal cover rated for “Constant Use” for receptacles identified as “WP” and that are exposed to the weather.
5. Use Crouse-Hinds DS185 cover for all switches identified as “WP”.

PART 3 EXECUTION

3.01 DIVISION OF WORK

A. The Contractor shall have overall system responsibility and shall provide all materials and labor necessary provide a complete and operable system and comply with all requirements of this section.

B. The Contractor shall be responsible for coordinating device locations with actual equipment conditions and requirements.

3.02 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact wiring device locations on the contract drawings.

B. Adjust location of wiring devices to satisfy field requirements.

3.03 INSTALLATION

A. Wiring Device Installation:
1. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
2. Provide extension rings to bring outlet boxes flush with finished surface.
3. Clean debris from outlet boxes.
4. Install products in accordance with manufacturer's instructions.
5. Install devices plumb and level.
6. Install switches with OFF position down.

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7. Install receptacles with grounding pole on top.
8. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
9. Install plates on switch, receptacle, and blank outlets in all areas.
10. Connect wiring devices by wrapping conductor around screw terminal.
11. Provide stainless steel hardware.
12. Install wall switch 46 inches above finished floor to centerline.
13. Install convenience receptacle in office space at 18 inches above finished floor to centerline.
14. Install convenience receptacle in electrical, process, mechanical or storage room at 42 inches above finished floor to centerline.
15. Install convenience receptacle 6 inches above counter to centerline.
16. Install convenience receptacle 4 inches above counter backsplash to centerline.
17. Install exterior convenience receptacle 30 inches above finished grade to centerline.
18. Adjust devices and wall plates to be flush and level.

B. Structural Coordination:
1. Verify outlet boxes are installed at proper height.
2. Verify wall openings are neatly cut and will be completely covered by wall plates.
3. Verify floor boxes are adjusted properly.

3.04 TESTING AND STARTUP SERVICES

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

PART 4 MEASUREMENT AND PAYMENT

4.01 WIRING DEVICES

A. Wiring devices shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the bid schedule or special Procedures - Division 1.
1. Wiring Devices, Lump Sum. Where so provided, payment for wiring devices shall be made at the contract lump sum price bid or as specified in special conditions - Division 1.
2. Wiring Devices, Inclusive. When no quantity is provided, wiring devices requirements shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
      b. ANSI Z535.4 - Product Safety Signs and Labels.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

1.03 DESCRIPTION OF WORK

A. Furnish and install electrical identification systems as indicated on the drawings and as specified herein.

1.04 SUBMITTALS - NOT USED

1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.07 QUALITY ASSURANCE - NOT USED

1.08 WARRANTY - NOT USED

1.09 EXTRA MATERIALS - NOT USED

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Engraved three-layer laminated plastic, black letters on white background.

B. Lettering:
   1. 1/4-inch letters for identifying individual equipment and loads.
   2. 1/2-inch letters for identifying grouped equipment and loads.

2.02 CONDUCTOR MARKING

A. The ends of each conductor shall be marked with circuit number, motor number, wire or terminal number.

B. Control system wire marking shall be coordinated with control system and equipment shop drawings.

C. Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink sleeve. Markers shall be shrunk around the wire to ensure a tight, non-slip bond with a compatible heat gun.

D. Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322.

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2.03 CONDUCTOR COLOR CODING

A. Conductors No.6 AWG and smaller shall be provided with color coded insulation as described herein. Conductors larger than No.6 AWG may be color coded with appropriately colored Scotch No.35 tape at each end.

B. Color Coding:
1. 277/480 vac system shall be colored brown, orange, yellow, and gray for phases A, B, C, and neutral respectively.
2. 120/208 vac system shall be colored black, red, blue, and white for phases A, B, C, and neutral respectively.
3. 120/240 vac shall be colored black, red, and white for Line 1, Line 2, and neutral respectively.
4. 120 vac control wiring shall be colored red.
5. 24 VDC control wiring shall be colored purple and purple with white stripe for positive and negative conductors respectively.
6. Intrinsically safe control wiring shall be colored light blue.
7. Conductors within control cabinets and motor control centers which are supplied from an external source shall be colored yellow.
8. Grounding conductor and equipment ground conductors shall be colored green.

2.04 EQUIPMENT, ENCLOSURE, AND CABINET WARNING SIGNS

A. Electrical Voltage and Shock Hazard Signs
1. Provide OSHA Voltage and Shock Hazard sign for each electrical enclosure, cabinet, or other piece of equipment that presents an electrical hazard under normal operating circumstances or presents an electrical hazard while the enclosure is open.

B. Electrical Arc Flash Hazard Signs
1. Provide Arc Flash Hazard sign for each each electrical enclosure, cabinet, or other piece of equipment that presents an arc flash hazard in accordance with NEC and ANSI Z535.4.

C. Electrical Source Signs
1. Provide sign indicating voltage level and source for each component of the power distribution system and for all control panels.
2. Provide indicating multiple sources where equipment is fed from multiple sources or where signal wiring is present that is powered from a source external to the equipment

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS - NOT USED

3.02 DELIVERY, STORAGE, AND HANDLING - NOT USED

3.03 INSTALLATION

A. Nameplates:
1. Provide nameplates for grouped equipment such as panelboards, transformers, motor control centers, and control panels. Nameplate shall identify tag number, voltage, ampere rating, and description.
2. Provide nameplates for individual equipment such as motor control center compartments, field instruments, and field control stations. Nameplate shall identify tag number and description.
3. Provide nameplates for individual receptacles. Nameplate shall identify panel and circuit number supplying the receptacle.
4. Provide nameplates for control cabinets and motor control center compartments which contain wiring supplied from an external source. Nameplate shall state: Multiple power sources within, verify all power supplies are disconnected before servicing equipment.
5. Nameplates shall be secured to the front of equipment enclosures with stainless steel screws or rivets. Double sided tape will not be acceptable.

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6. Secure nameplates for flush mounted panelboards behind the panelboard door.

B. Conductor Marking:
   1. Mark conductors at every termination and splice point.
   2. Mark conductors with wire numbers identified by control system supplier, with panel and circuit identification, or with MCC compartment and wire numbers.

C. Conduit Marking:
   1. Furnish colored band markers for each conduit longer than six feet and mark each conduit a minimum of twenty feet on center.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. Identification for Electrical Systems shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Identification for Electrical Systems, Lump Sum. When so provided, payment for Identification for Electrical Systems shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Identification for Electrical Systems, Inclusive. When no quantity is provided, Identification for Electrical Systems shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 05 75
ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
      b. NFPA 70E - Standard for Electrical Safety in the Workplace
   2. Institute of Electrical and Electronics Engineers (IEEE), Specifications and Standards, current edition:
      a. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
      b. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
      c. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
      d. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
      e. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
      f. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

1.03 DESCRIPTION OF WORK

A. Furnish short-circuit and protective device coordination studies.

B. Furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current issue of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 - 2018, the IEEE Guide for Performing Arc-Flash Calculations.

C. The electrical power system studies shall encompass the following electrical equipment located at the proposed PRV Station:
   1. Electrical System as shown on One-Line drawings for PRV Station.
   2. Study shall provide information on Main breaker of each panel and largest load breaker in each panel.

D. The electrical power system studies shall encompass the following electrical equipment located at the proposed North Booster Station:
   1. Service Entrance Fused Disconnect: 30-MDS-1
   2. Automatic Transfer Switch: 30-ATS-1
   3. Standby Generator: 30-G-1
   4. Electrical System as shown on One-Line drawings for North Booster Station.
   5. Study shall provide information on Main breaker of each panel and largest load breaker in each panel.

1.04 RELATED SECTIONS - NOT USED

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

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B. Preliminary short-circuit and protective device coordination studies shall be submitted and approved prior to the approval of any electrical equipment submittals that may be affected by the results of the study.

C. Final short-circuit, protective device coordination, and arc flash hazard analysis studies shall be prepared and submitted based upon actual installed system characteristics.

D. Submit the following information specifically for Electrical Systems Analysis:
   1. The results of the short-circuit, protective device coordination, and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. Electronic PDF copies of the report shall be provided.
   2. The report shall include the following sections:
      a. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
      b. Short-Circuit Methodology Analysis Results and Recommendations
      c. Short-Circuit Device Evaluation Table
      d. Protective Device Coordination Methodology Analysis Results and Recommendations
      e. Protective Device Settings Table
      f. Time-Current Coordination Graphs and Recommendations
      g. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
      h. Arc Flash Labeling section showing types of labels to be provided. Section shall contain descriptive information as well as typical label images.
      i. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.
   3. Submit an electronic version of the software model used to prepare the final short-circuit, protective device coordination, and arc flash hazard analysis studies.

1.06 FACTORY TESTING - NOT USED

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED

1.08 QUALITY ASSURANCE

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed.

E. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program or an approved equivalent software tool.

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PART 2 PRODUCTS

2.01 DATA COLLECTION

A. Field data collection shall be performed by a technician, qualified (as defined by NFPA 70E - 2004) to ensure accurate equipment modeling. The technician shall have completed an 8-hour instructor-led Electrical Safety Training Course. The course shall include NFPA 70E training which includes the selection and use of personal protective equipment.

B. The technician shall visually inspect to verify the equipment ratings, conductor ratings and overcurrent device data by removing panels, covers and doors where required to document the necessary data used in the analysis. The technician shall be qualified to perform these inspections with the equipment energized provided the incident energy values are less than 40cal/cm², greater values or unusual site conditions will require an equipment shutdown so the equipment can be inspected de-energized.

C. The Owner or Contractor shall provide qualified personnel to show the technician the equipment locations and to open all equipment doors, locks, etc. necessary to collect nameplate data.

D. Verify one-line drawings and provide marked corrections where discrepancies are found..

E. Data collection shall begin downstream from the utility service and continue down through the electrical distribution system as defined under scope of work. The study shall not include any single phase AC circuits or DC distribution systems as these types of circuits and systems are excluded from IEEE 1584 Arc Flash calculation guidelines. The study need not include equipment rated 240 volts or less per NFPA 70E, when supplied by a single transformer rated less than 125kVA.

F. Obtain from the utility the minimum, normal, and maximum operating service voltage levels, three-phase short circuit MVA and X/R ratio, as well as line-to-ground short circuit MVA and X/R ratio at the point of connection as shown on the drawings.

2.02 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:
   1. Calculation methods and assumptions
   2. Selected base per unit quantities
   3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
   4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
   5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
   6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short circuit ratings

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2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Identify in writing, any circuit protective devices improperly rated for the calculated available fault current.

2.03 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility's overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Medium voltage conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:
1. A one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
6. Identify in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

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2.04 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis and the protective device time-current coordination analysis.

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.

D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

G. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond 5 cycles.

I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically

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possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

M. Provide the following:
1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
a. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
1) The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 EXECUTION

3.01 FIELD ADJUSTMENT

A. The Contractor or equipment manufacturer's start-up technician shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. The Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Square D shall notify Owner in writing of any required major equipment modifications.

3.02 ARC FLASH LABELS

A. Provide a 4.0 in. x 4.0 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed according to the following standards:
1. UL969 - Standard for Marking and Labeling Systems
2. ANSI Z535.4 - Product Safety Signs and Labels
3. NFPA 70 (National Electric Code) - Article 110.16

C. The label shall include the following information:
1. System Voltage
a. Flash protection boundary
b. Personal Protective Equipment category
c. Arc Flash Incident energy value (cal/cm²)
d. Limited, restricted, and prohibited Approach Boundaries
1) Study report number and issue date

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
2. Wall Mounted Equipment - Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.

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3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Label Installation

1. Labels shall be field installed by the Contractor. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.03 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 ELECTRICAL SYSTEMS ANALYSIS

A. Electrical Systems Analysis shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Electrical Systems Analysis , Lump Sum. When so provided, payment for Electrical Systems Analysis shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Electrical Systems Analysis , Inclusive. When no quantity is provided, Electrical Systems Analysis shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA ST 1 - Specialty Transformers
      b. NEMA ST20 - Dry Type Transformers for General Applications.
   4. International Electrical Testing Association (NETA)
      a. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      a. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers.
   6. Department of Energy 10 CFR Part 431.

1.03 DESCRIPTION OF WORK

A. The primary overcurrent protective devices and associated feeder conductors for dry type transformers shown on one-line drawings are sized for 125% of the transformer nameplate primary current. If the manufacturer elects to supply transformers that require higher rated primary overcurrent protective devices to account for higher inrush characteristics, then the manufacturer shall be responsible for communicating the requirements for manufacturer recommended primary overcurrent protection to all contractors prior to project bidding.

B. Furnish and install complete and operable lighting and distribution transformers as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for low voltage transformers:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Performance data and physical dimensions including outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

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1.05 FACTORY TESTING - NOT USED

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS - NOT USED

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: All transformers provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than fifty years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 ENERGY EFFICIENT, DRY-TYPE TRANSFORMERS

A. Manufacturer:
1. Square D.
2. Cutler-Hammer.
3. or equal.

B. Ratings:
1. Insulating materials shall exceed NEMA ST20 standards and be rated for 220 degree C, UL component recognized insulation system.
2. Transformers rated 15kVA and larger shall be 150 degree C temperature rise above 40 degree C ambient.
3. Transformers rated 25kVA and larger shall have a minimum of 4 - 2.5 percent full capacity primary taps.
4. The maximum temperature of the top of the enclosure shall not exceed 50 degree C rise above a 40 degree C ambient.
5. Transformer voltage and kVA ratings shall be as indicated on the drawings.

C. Efficiency:
1. Transformers shall be low loss type with minimum efficiencies per Department of Energy 10 CFR 431.196, (a) (2) when operated at 35 percent of full load capacity. Efficiency shall be tested in accord with DOE Test Method for Measuring the Energy Consumption of Distribution Transformers under Appendix A to Subpart K of 10 CFR Part 431.
2. Minimum transformer efficiency shall comply with the following table:

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TRANSFORMER MINIMUM EFFICIENCY			
SINGLE PHASE		THREE PHASE	
KVA	PERCENT EFFICIENCY	KVA	PERCENT EFFICIENCY
15	97.7	15	97.89
25	98.0	30	98.23
37.5	98.2	45	98.40
50	98.3	75	98.60
75	98.5	112.5	98.74
100	98.6	150	98.83
167	98.7	225	98.94
250	98.8	300	99.02
333	98.9	500	99.14
		750	99.23

D. Construction:
   1. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.
   2. All cores shall be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.
   3. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
   4. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

E. Sound Levels:
   1. Sound levels shall not to exceed the following:
      a. 15 to 50KVA - 45dB
      b. 51 to 150kVA - 50dB
      c. 151 to 300kVA - 55dB
      d. 301 to 500kVA - 60dB
      e. 501 to 700kVA - 62dB
      f. 701 to 1000kVA - 64dB
      g. 1001 to 1500kVA - 65dB
      h. 1501 to 2000kVA- 66dB

F. Accessories
   1. Provide the following accessories where indicated on the drawings:
      a. Weathershields
      b. Wall mounting brackets.
      c. Ceiling mounting brackets.

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PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact transformer locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust transformer installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept transformers on site. Inspect for damage.

B. Protect transformers from corrosion and entrance of debris.

C. Store transformers above grade. Protect from environment with suitable covering.

D. Handle transformers using only lifting eyes and brackets provided for that purpose.

3.03 INSTALLATION

A. General:
   1. Install transformers in accordance with NECA "Standard of Installation.", all requirements of the NEC, and manufacturer recommended practices.

B. Separately Mounted Transformer Installation:
   1. Set transformer plumb and level.
   2. Use flexible conduit, 2-foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
   3. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
   4. Provide sufficient space around transformer for cooling as recommended by the manufacturer.

C. Structural Coordination:
   1. Provide structural supports suitable for the transformer weight for wall and ceiling mounted units.

3.04 TESTING AND START-UP SERVICES

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments within 2-1/2 percent of the nominal operating voltage after the building is in full operation.

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 LOW-VOLTAGE TRANSFORMERS

A. Low-Voltage Transformers shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Low-Voltage Transformers, Lump Sum. When so provided, payment for Low-Voltage Transformers shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.

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2. Low-Voltage Transformers, Inclusive. When no quantity is provided, Low-Voltage Transformers shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
      a. NEMA PB 1 - Panelboards
      b. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
      c. NEMA AB 1 - Molded Case Circuit Breakers.
      d. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
      e. NEMA 250 - Enclosures for Electrical Equipment.
   4. International Electrical Testing Association (NETA)
      a. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL 50 - Enclosures for Electrical Equipment
      b. UL 67 - Panelboards.
      c. UL 98 - Enclosed and Dead-front Switches
      d. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
   6. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
      b. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
   7. Federal Specifications and standards, current edition:
      a. W-P-115C - Type I Class 1
      b. W-C-375B - Molded Case Circuit Breakers
      c. W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.
      d. W-P115C - Type 1 Class 2 Load Center

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable panelboards as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for panelboards:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.

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2. Overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. Illustrate one line diagrams with applicable voltage systems.
3. Equipment ratings for voltage, amperage, and short circuit.

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit the following information specifically for panelboards:
1. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: All panelboards provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than fifty years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Panelboard manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.07 WARRANTY

A. See Division 01 for additional requirements.

1.08 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 480VAC LIGHTING AND APPLIANCE PANELBOARDS

A. Manufacturers:
1. Square D Company NF - Class 1670
2. Cutler-Hammer Pow-R-Line
3. or equal

B. Interior:
1. Rated 480Y/277 vac maximum. Continuous main current ratings, as indicated on drawings, not to exceed 600 amperes maximum for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
2. UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.
3. Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated.

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Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar.

4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.
7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Interior phase bus shall be pre-drilled to accommodate field installable options such as sub-feed lugs, sub-feed breakers, thru-feed lugs.

C. Circuit Breakers:
1. Main circuit breakers shall be vertically mounted.
2. Sub-feed circuit breakers shall be vertically mounted.
3. Interiors shall accept 125A breakers in group mounted branch construction.
4. Molded case branch circuit breakers shall have bolt-on type bus connectors.
5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
6. The exposed faceplates of all branch circuit breakers shall be flush with one another.

D. Enclosures:
1. Type 3R, 5, and 12:
   a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   b. All doors shall be gasketed and equipped with a tumbler type vault lock and two additional quarter turn fasteners on enclosures 59-inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
   c. Maximum enclosure dimensions shall not exceed 21-inches wide and 9.5-inches deep.

2.02 240VAC LIGHTING AND APPLIANCE PANELBOARDS

A. Manufacturers:
1. Square D Company NQ - Class 1640
2. Cutler-Hammer Pow-R-Line
3. or equal

B. Interior:
1. Rated for 240VAC / 48VDC maximum. Continuous main current ratings, as indicated on the drawings, not to exceed 600 amperes maximum.
2. UL Listed short circuit current ratings as indicated on the drawings with a maximum of 200,000 RMS symmetrical amperes.
3. Provide one continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire

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length of the bus bar. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.

4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where indicated on the drawings.
6. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200 percent rated solid neutrals shall have plated copper neutral bus for non-linear load applications where indicated on the drawings.
7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
9. Interiors shall be field convertible for top or bottom incoming feed. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
10. Circuit Breakers:
    a. Main circuit breakers shall be vertically mounted.
    b. Sub-feed circuit breakers shall be vertically mounted.
    c. Molded case branch circuit breakers shall have bolt-on type bus connectors.
    d. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
    e. The exposed faceplates of all branch circuit breakers shall be flush with one another.

C. Enclosures:

1. Type 3R, 5, and 12:
    a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
    b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59-inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
    c. Maximum enclosure dimensions shall not exceed 21-inches wide and 6.5-inches deep.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.
6. Circuit breakers shall be factory sealed with a hologram quality mark and shall have date code on face of circuit breaker.
7. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be

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marked on the end use equipment along with the statement "Caution - Series Rated System. _____ A Available. Identical Replacement Component Required".

8. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.
9. The circuit breakers shall be UL Listed for use with and provided with the following accessories where indicated on the drawings: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position for all circuits that supply exit signs, emergency lights, energy management, control system panels, and fire alarm panels.
10. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
11. Circuit breakers shall be fixed construction with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable lugs. Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90 degree C rated wire, sized according to the 75 degree C temperature rating in the National Electrical Code.
12. All circuit breakers shall be capable of accepting bus connections.
13. Any circuit breaker not set to the maximum trip rating shall be equipped with NEC locking mechanism.

B. Thermal-Magnetic Circuit Breakers

1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40 degree C ambient temperature.
3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.
4. Standard two- and three-pole circuit breakers up to 250 amperes at 600 VAC shall be UL Listed as HACR type.

C. Electronic Trip Circuit Breakers with Standard Function Trip System

1. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the drawings.
2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80 percent of their ampere rating continuously.
4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
   a. Long Time Pickup Instantaneous Pickup.
   b. Long Time Delay.
   c. Short Time Pickup (I^2t OUT only).
   d. Short Time Delay (I^2t IN only).
5. A means to seal the trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
6. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
7. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on

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circuit breakers with integral ground fault protection. All current values shall be displayed in true rms with 2 percent accuracy.

8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
9. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
10. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
11. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact panelboard locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust panelboard installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept panelboard on site. Inspect for damage.

B. Protect panelboard from corrosion and entrance of debris.

C. Store panelboard above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install panelboards plumb and flush with wall finishes.

B. Install panelboards such that top of panel is located at an elevation of 6-feet above finished floor elevation.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

E. Stub five empty 1-inch conduits to accessible location above ceiling or below floor of each flush-mounted panelboard to allow for future expansion.

F. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent. Take care to maintain proper phasing for multi wire branch circuits.

G. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

H. Verify that bonding jumper is properly installed in service entrance rated panels.

I. Thoroughly clean and remove construction debris from panelboard interior and exterior.

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3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 PANELBOARDS

A. Panelboards shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Panelboards, Lump Sum. When so provided, payment for Panelboards shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Panelboards, Inclusive. When no quantity is provided, Panelboards shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 28 19
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
         1) NFPA 70 - National Electrical Code.
      b. National Electrical Contractors Association (NECA), Standard of Installation, current edition.
      c. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
         1) NEMA FU 1 - Low Voltage Cartridge Fuses
         2) NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
         3) NEMA 250 - Enclosures for Electrical Equipment.
      d. International Electrical Testing Association (NETA)
         1) NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
      e. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
         1) UL 98 - Enclosed and Dead Front Switches

1.03 DESCRIPTION OF WORK

A. Furnish and install complete and operable enclosed switches as indicated on the drawings and as specified herein.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for enclosed switches:
   1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Outline drawings with dimensions.
   3. Equipment ratings for voltage, amperage, horsepower and short circuit.

1.05 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Division 01 for additional requirements.

1.07 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Supply five spare fuses of each type supplied for this project

PART 2 PRODUCTS

2.01 250VAC/600VAC HEAVY DUTY DISCONNECT SWITCH

A. Manufacturers:
1. Square D Company
2. Cutler-Hammer
3. or equal

B. Switch Interior:
1. All switches shall have switch blades which are visible when the switch is off and the cover is open.
2. Lugs shall be front removable and UL Listed for 60 degree C or 75 degree C aluminum or copper conductors as required by the application.
3. Fusible switches shall be equipped with factory installed or field installed fuse pullers.
4. Switches shall be equipped with plated copper current carrying parts to resist corrosion.
5. Switches shall be equipped with removable arc suppressors to facilitate access to line side lugs.
6. Switches shall have provisions for a field installable electrical interlock.

C. Switch Mechanism:
1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be restrained by the operating handle after the closing or opening action of the contacts has started.
2. The operating handle shall be an integral part of the box, not the cover.
3. The handle position shall travel at least 90 degrees between off and on positions to clearly distinguish and indicate handle position.
4. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is on and prevent turning the switch on when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

D. Switch Enclosures:
1. Environmental Rating:
   a. Service entrance switch, exterior: Type 4X, stainless steel.
   b. Service entrance switch, interior: Type 1.
   c. Disconnect switch, exterior: Type 4X, stainless steel.
   d. Disconnect switch, interior: Type 4X, stainless steel.
   e. Disconnect switch, interior when EMT conduit is allowed: Type 1.
   f. Disconnect switch, hazardous location: Type 7/9.
2. Covers:
   a. Type 1, 4X stainless steel enclosures: attached with welded pin-type hinges.
   b. Type 7/9 enclosures: attached with Type 316 stainless steel bolts.
3. Finish:

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a. Type 1 enclosures: gray baked enamel paint electrodeposited on cleaned, phosphate pre-treated steel.
b. Type 4X stainless steel enclosures: brush finish on type 304 stainless steel.
c. Type 7/9 enclosures: gray baked enamel on copper free cast aluminum alloy.

4. The enclosure shall have on and off markings stamped or cast into the cover.
5. The operating handle shall be provided with a dual colored, red/black position indication.
6. All switches shall have provisions to accept up to three 3/8-inch hasp padlocks to lock the operating handle in the off position.
7. Exterior switches shall have provisions to accept one 3/8-inch hasp padlocks to lock the operating handle in the on position.
8. Conduit Entrance:
   a. Tangential knockouts shall be provided for Type 1 switches rated 30-200A.
   b. Watertight conduit hubs for Type 4X stainless steel switches.
   c. Threaded conduit openings in both end walls for Type 7/9 enclosures.
9. Cover sealing means for switches rated through 200 amperes shall be quick release trunk latches (Type 1, 4X stainless steel enclosures) and type 316 stainless steel bolts (Type 7/9 enclosures).
10. Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor applications.
11. Type 4X stainless steel enclosures shall be dual rated as Type 3R to facilitate their use in outdoor applications.

E. Switch Ratings:
1. Switch shall be suitable for use as service entrance equipment where use is indicated on the drawings.
2. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.
3. Switches shall be rated for the voltage applied.
4. The UL Listed short circuit current rating of the switches shall be:
   a. 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere).
   b. 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes).
   c. 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

2.02 FUSES

A. Manufacturers:
1. Bussmann
2. or equal

B. 250 Volt Fuses:
1. Class RK-1, one end rejection or to fit mountings specified. 0-600 ampere, 200,000 ampere interrupting rating.
2. Low-Peak LPN-R, dual element, time delay with short circuit protection for motor, transformer, feeder and main service protection.

C. 600 Volt Fuses:
1. Class RK-1, one-end rejection or to fit mountings specified, 0-600 ampere, 200,000 ampere interrupting rating.
2. Low-Peak LPS-R, dual element, time delay with short circuit protection. 0-600 ampere, 200,000 ampere interrupting rating for motor, transformer, feeder and main service protection.
3. Class L, bolt-in, 601-6,000 amperes, 200,000 ampere interrupting rating.
4. HI-CAP KRP-C, time delay for overload and short circuit protection. 601-6,000 amperes, 200,000 ampere interrupting rating for motor, transformer, feeder and main service protection.
5. Class CC, fast acting, single element, 0-30 amperes, 200,000 ampere interrupting rating.

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PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact enclosed switch locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Adjust enclosed switch installation to satisfy field requirements.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept enclosed switches on site. Inspect for damage.

B. Protect enclosed switches from corrosion and entrance of debris.

C. Store enclosed switches above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Install fuses where switches are indicated as fusible switches on the drawings.

B. Install enclosed switches plumb and level.

C. Install enclosed switches such that top of enclosure is located at an elevation of 6-feet above finished floor elevation.

D. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

E. Verify that bonding jumper is properly installed in service entrance rated switches.

F. Thoroughly clean and remove construction debris from switch interior and exterior.

3.04 TESTING AND START-UP SERVICES - NOT USED

3.05 TRAINING - NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 ENCLOSED SWITCHES

A. Enclosed Switches shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Enclosed Switches, Lump Sum. When so provided, payment for Enclosed Switches shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Enclosed Switches, Inclusive. When no quantity is provided, Enclosed Switches shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 29 23
ADJUSTABLE FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   2. Canadian Standards Associates (CSA), Specifications and Standards, Current Edition.
   3. European Committee for Electrotechnical Standardization (CENELEC), Current Edition.
      a. EN 60947 - Low-Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters
   4. Electrical and Electronic Manufacturers Association Canada (EEMAC), Specifications and Standards, Current Edition.
   5. Institute of Electrical and Electronics Engineers (IEEE), current edition.
      a. IEEE 519-1992 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
   6. International Electrotechnical Association (IEC), Specifications and Standards, Current Edition:
      a. IEC-60439 - Low Voltage Switchgear and Control Gear Assemblies.
   7. National Electrical Contractors Association (NECA), current edition.
      a. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.
   8. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition:
      a. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
      b. ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.
      c. ICS 4-2000 - Industrial Control and Systems: Terminal Blocks.
      d. ICS 5-2000 - Industrial Control and Systems: Control Circuit and Pilot Devices.
      e. ICS 6-1993 - Industrial Control and Systems Enclosures
      f. ICS 7-1993 - Industrial Control and Systems Adjustable-Speed Drives
      g. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
   9. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition:
      a. 4.UL 508C - Power Conversion Equipment.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control

B. Furnish and install complete and operable adjustable frequency drive systems as indicated on the drawings and as specified herein.

C. Adjustable frequency drive systems work may include work in new motor control centers and/or work in existing motor control centers. Refer to the drawings for detailed description of the work.

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1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein As part of the submittal for the complete, integrated process instrumentation and control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. The following information shall be submitted specifically for adjustable frequency drive systems:
   1. Submit harmonic voltage distortion analysis based upon the minimum three phase bolted fault short circuit current available at the point of service. Submittal data shall not relieve contractor of specified performance requirements. Analysis shall include:
      a. Calculate percent voltage distortion, with respect to fundamental voltage, for all harmonics up to the 99th.
      b. Comparison with IEEE 519 standards for acceptable voltage distortions on such systems.

1.05 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated process instrumentation and control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. The following information shall be provided specifically for adjustable frequency drive systems:
   1. Motor controller data listing identifying the configured values of all adjustable settings and configurable parameters.

1.06 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications:
   1. All equipment provided under this section shall be the products of a single company specializing in manufacturing products specified in this section, with not less than twenty years of documented experience.
   2. The adjustable frequency drive system manufacturer shall have been engaged in the manufacture of PWM style adjustable frequency drives for a minimum of ten years.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. Adjustable frequency drive system manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.07 WARRANTY

A. See Division 01 for additional requirements.

1.08 EXTRA MATERIALS

A. See Division 01 for additional requirements.

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PART 2 PRODUCTS

2.01 MANUFACTURER

A. Asea Brown-Boveri (ABB) ACQ580-01 Series

2.02 GENERAL

A. Contractor shall note Booster Pump wall mounted drives width limitations as shown on drawings. Drives shall be NEMA 12 rated and ventilate from the back to allow for side-by-side drive placement. Drives shall not be in a control panel.

B. Provide adjustable frequency, drive control systems capable of converting the scheduled voltage, 3-phase, 60 Hz, input power into variable voltage, adjustable frequency, 3-phase output of suitable capacity and waveform to serve as input power to squirrel cage induction motors of the scheduled characteristics (constant or variable torque).

C. Harmonic Distortion:
1. The adjustable frequency drive systems shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10 percent total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when operated from the same bus.
2. Individual or simultaneous operation of the adjustable frequency drive systems shall not add more than 5 percent total harmonic voltage distortion to the normal bus, nor more than 10 percent while operating from the standby generator in accordance with IEEE 519, 1992.
3. Maximum total and individual harmonic current distortion limits for each odd harmonic shall not exceed those set forth by IEEE 519, Latest Edition.
4. If harmonic filters or reactors are needed to meet these requirements, then the manufacturer shall provide and be responsible for the design and manufacture of these items.

2.03 RATINGS

A. The drive shall accept an input voltage of the nominal three phase voltage indicated on the drawings, plus or minus 10 percent.

B. Displacement power factor: shall range between 1.0 and 0.95, lagging, over the entire speed range.

C. Efficiency: minimum of 97 percent at full load and speed.

D. Environmental Ratings:
1. Storage ambient temperature range: -40 to 70 degrees C.
2. Operating ambient temperature range: 0 to 40 degrees C without derating.
3. Relative humidity range: 5 to 95 percent non-condensing.
4. Operating elevation: up to 1000 meters without derating.

E. Provide redundant, thermostatically controlled ventilation fans to maintain interior of drive enclosure within the specified environmental ratings.

F. Output power Ratings:
1. The output voltage shall be adjustable from 0 to rated input voltage.
2. The output frequency range shall adjustable from 0 to 400Hz.
3. The inverter section shall produce a pulse width modulated (PWM) waveform using latest generation IGBTs.

2.04 DRIVE UNIT DESIGN

A. Hardware:

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1. Utilize diode or fully gated bridge on the input.
2. Utilize DC bus inductor on all drives rated 7.5hp or greater.
3. Utilize switching logic power supply operating from the DC bus.
4. Incorporate phase to phase and phase to ground MOV protection.
5. Utilize gold plated plug-in connections on printed circuit boards.
6. Microprocessor based inverter logic shall be isolated from power circuits.
7. Utilize latest generation IGBT inverter section.
8. Inverter section shall not require commutation capacitors.
9. Employ interface common for all horsepower ratings. Interface shall include a LCD digital display and programming keypad.
10. Utilize a main control board with common control connections for all ratings.

B. Control Design:
1. The drive design shall be optimized for NEMA Design B motors.
2. The drive design shall allow for operation of the drive with the motor disconnected.
3. Provide a controlled shut down, when properly fused, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.
4. Utilize an adjustable PWM carrier frequency within a range of 2 to 8 kHz to help eliminate audible noise.
5. Provide either Selectable Sensorless Vector or V/Hz modes.
6. The drive shall have the capability of selecting operation for either variable or constant torque loads. Selection of variable torque shall provide 115 percent of rated VT current for up to one minute. Selection of constant torque shall provide 150 percent of rated CT current for up to one minute.
7. Provide multiple programmable stop modes including:
   a. Ramp
   b. Coast
   c. DC-Brake
   d. Ramp-to-Hold
   e. S-Curve
8. Provide multiple acceleration and deceleration rates.
9. The drive shall have an adjustable output frequency up to 400Hz.
10. The drive shall be capable of sensing a loss of the speed reference.
11. All adjustments shall be made with the door closed.

C. Power Conditioning:
1. The drive shall be designed to operate on an AC line which may contain line notching and up to 10 percent harmonic distortion.
2. An input isolation transformer shall not be required for protection from normal line transients. If line conditions dictate the use of a transformer, the K factor shall be 4.0 or less.

2.05 DRIVE UNIT FEATURES

A. Control Mode:
1. Selectable sensorless vector or V/Hz mode selectable through programming.
2. The sensorless vector mode shall use motor nameplate data plus motor operating data such as IR drop, nominal flux current and flux up time.
3. The volts per hertz mode shall be programmable for squared, cubed, straight line, pre-programmed or full custom patterns.

B. Current Limit:
1. Programmable current limit from 20 to 160 percent of constant torque rating.
2. Current limit shall be active for all drive states: accelerating, constant speed and decelerating.
3. The drive shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit.

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C. Acceleration / Deceleration:
   1. Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 to 3600 seconds.
   2. A second set of remotely selectable Accel/Decel settings shall be accessible through the control interface.
   3. An adaptive current limit circuit shall be available and capable of being disabled through programming for fast acceleration of low inertia loads.

D. Speed Regulation Modes:
   1. Open Loop.
   2. Slip Compensation with 0.5 percent speed regulation.
   3. Droop - Negative Slip Compensation with 0.5 percent speed regulation.
   4. Traverse Function.
   5. Closed loop encoder feedback with 0.1 percent speed regulation.
   6. Process PI control.

E. Speed Profiles:
   1. Programming capability shall allow the user to produce speed profiles with linear acceleration/deceleration or "S-Curve" profiles that provide changing accel/decel rates.
   2. S-Curve profiles shall be selectable for fixed or adjustable values.

F. Adjustments:
   1. A digital interface shall be used for all set-up, operation and adjustment settings.
   2. All adjustments shall be stored in nonvolatile memory (EEPROM).
   3. No potentiometer adjustments shall be required.
   4. The drive shall provide EEPROM memory for factory default values.

G. Process PI Control:
   1. The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.
   2. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the setpoint, the regulator shall adjust the drive output until the feedback equals the reference.
   3. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
   4. Protection shall be provided for a loss of feedback or reference signal.

H. Fault Reset / Run:
   1. The drive shall provide up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
   2. Ground fault, shorted output faults, and other internal microprocessor faults shall not automatically reset/restart.
   3. The time between restarts shall be adjustable from 0.5 to 30 seconds.

I. Skip Frequencies:
   1. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
   2. The set points shall have a bandwidth adjustable from 0 to 15Hz.

J. Run on Power Up:
   1. A user programmable restart function shall be provided to automatically restart the equipment after restoration of power after an outage.

K. Line Loss Restart:
   1. The drive shall have a line loss restart function. This programmable function shall select the reconnect mode of the drive after recovery from a line loss condition.

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2. The reconnect modes shall be Last Speed, Speed Search, Track Volts, or Use Encoder.
3. This feature shall be capable of being disabled thus forcing the drive to start from zero hertz.

L. Fault Memory:
1. The last four faults as well as operating frequency, drive status and power mode shall be stored at the time of fault.
2. Information shall be maintained in the event of a power loss.

M. Overload Protection:
1. The drive shall provide internal Class 10 motor overload protection investigated by UL to comply with N.E.C. Article 430.
2. Overload protection shall be speed sensitive and adjustable for motors with speed ranges of 2:1, 4:1 and 10:1.
3. A viewable parameter shall store the overload usage in percent.
4. An alarm bit shall be available to adjust a process to eliminate an overload trip.

N. Auto Economizer:
1. An auto economizer feature shall automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage. If the load increases, the drive shall automatically return to normal operation.

O. Flying Start:
1. The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed.
2. The flying start feature shall be operable with or without encoder feedback.

P. Control Logic Ride Through:
1. The control logic shall be capable of "riding through" a power outage of up to 2 seconds in duration.

Q. Inertia Ride Through:
1. The drive shall respond to a loss of AC input power by adjusting the output frequency to create a regenerative situation in the motor. The regenerated energy shall be used to power the drive logic during the power outage.
2. The amount of voltage drop required to trigger inertial ride through and the level at which regulation occurs shall both be adjustable.
3. Inertia ride through shall be capable of being enable or disable through programming.

R. Inputs and Outputs:
1. The standard Input / Output board shall consist of both analog and digital I/O.
2. No jumpers or switches shall be required to configure inputs and outputs. All functions shall be fully programmable.
3. If standard Input/ Output board does not have specified I/O additional add-on modules shall be utilized to provide required I/O.
4. The Input / Output board shall have the following analog inputs as standard.
    a. Quantity one (1) differentially isolated plus or minus 10V (bi-polar) / 20mA, 11 bit plus sign, 10V common mode noise rejection
    b. Quantity one (1) differentially isolated plus or minus 10V (bi-polar) / 20mA, 11 bit plus sign, 160V common mode noise rejection
5. The Input / Output board shall have the following analog outputs as standard.
    a. Quantity one (1) differentially isolated plus or minus 10V (bi-polar) / 20mA, 11 bit plus sign.
    b. The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power.

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c. Programming shall be available to select either absolute or signed values of these parameters.

6. The Input / Output board shall have the following digital inputs as standard.
   a. Quantity of six (6) digital inputs rated 120Vac
   b. All inputs shall be individually programmable for functions from a list of twenty-nine (29) that includes Start, Run, Stop, External Fault, Speed Select, Jog and Process PI functions.
7. The Input / Output board shall have the following digital outputs as standard.
   a. Quantity of three (3) relay outputs, form C (1 N.O. - 1 N.C.)
   b. Contact output ratings shall be 250Vac / 30Vdc (2.0 Amps maximum), resistive or inductive.
   c. Relays shall be programmable to twenty-six (26) different conditions including Fault, Alarm, At Speed, Drive Ready and PI Excess Error.
   d. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.

S. Reference Signals:
1. The drive shall be capable of using the following input reference signals
   a. Analog inputs
   b. Preset speeds
   c. Remote potentiometer
   d. Digital MOP
   e. Human Interface
   f. Communication module commands

T. Communication:
1. The drive shall be capable of communicating with an Ethernet/IP network.
2. The drive shall be configured such that multi-cast traffic is turned off and all Ethernet messages shall be discriminate communications.

U. Loss of Reference:
1. In the event of loss of the reference signal, the drive shall be user programmable to the following:
   a. Fault the drive
   b. Alarm and maintain last reference
   c. Alarm and go to preset speed
   d. Alarm and go to minimum speed
   e. Alarm and go to maximum speed
   f. Alarm and maintain last output frequency

V. Metering:
1. The following parameters shall be accessible through the human interface module:
   a. Output Current in Amps
   b. Output Voltage in Volts
   c. Output Power in kW
   d. Elapsed MWh
   e. DC Bus Voltage
   f. Output Frequency
   g. Heatsink Temperature
   h. Last eight (8) faults
   i. Elapsed Run Time

W. Faults:
1. Fault information shall be accessible through the human interface module.
2. A fault buffer shall store the last four faults in a first-in / first-out manner.
3. At a minimum the following faults shall be displayed:
   a. Power Loss.
   b. Undervoltage.

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c. Overvoltage.
d. Overload.
e. Overtemperature (Heat Sink).
f. Overcurrent detected in instantaneous overcurrent trip circuit
g. Maximum retries.
h. Phase-to-phase and phase-to-ground faults.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base exact equipment locations on the contract drawings.

B. Identify conflicts with the work of other trades prior to installation of electrical equipment.

C. Identify deviation from physical sizes shown on the drawings to Engineer prior to bid date.

D. Contractor shall be responsible for modifications to the installation due to deviations from physical sizes shown on the drawings.

E. Identify conflicts with the work of other trades prior to installation of electrical equipment.

F. Record nameplate data for each motor served.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Accept adjustable frequency motor controllers on site. Inspect for damage.

B. The Contractor shall be responsible for all equipment necessary to receive, unload, move into building, and install motor control centers.

C. The Contractor shall be responsible for coordinating specific shipping split requirements with the manufacturer/supplier.

D. Conform to written instructions of manufacturer.

E. Protect adjustable frequency motor controllers from corrosion and entrance of debris.

F. Store adjustable frequency motor controllers above grade. Protect from environment with suitable covering.

3.03 INSTALLATION

A. Adjust disconnecting means trip settings to satisfy motor nameplate requirements.

B. Record information for motor data labels and install motor data labels.

C. Adjust all programmable drive features, including but not limited to auto restart parameters. The drive system must automatically restart after a power fail condition.

D. Provide typed label inside each unit identifying configured values for all programmable drive parameters.

E. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of all connections.

F. Verify that cooling fans are operating properly.

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G. Thoroughly clean and remove construction debris from filters, enclosure interior, and exterior.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 ADJUSTABLE FREQUENCY MOTOR CONTROLLERS

A. Adjustable Frequency Motor Controllers shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Adjustable Frequency Motor Controllers, Lump Sum. When so provided, payment for Adjustable Frequency Motor Controllers shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Adjustable Frequency Motor Controllers, Inclusive. When no quantity is provided, Adjustable Frequency Motor Controllers shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 32 10
ENGINE GENERATORS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
      b. NFPA99 - Essential Electrical Systems for Health Care Facilities.
      c. NFPA110 - Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Perform level one prototype tests required by this standard on a complete and functional unit; component level type tests will not substitute for this requirement.
   2. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, No. 14 - M91 Industrial Control Equipment.
      b. CSA 282, 1989 Emergency Electrical Power Supply for Buildings.
   3. European Committee for Electrotechnical Standardization (CENELEC), Specifications and Standards, current edition:
      a. EN50082-2, Electromagnetic Compatibility - Generic Immunity Requirements, Part 2: Industrial.
      b. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
   4. Federal Communications Commission (FCC), Specifications and Standards, current edition:
      a. FCC Part 15, Subpart B.
   5. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC8528 part 4. Control Systems for Generator Sets.
      b. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
   6. Institute of Electrical and Electronics Engineers, Specifications and Standards, current edition:
      a. IEEE446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
      b. IEEE587 for voltage surge resistance.
   7. Military Standard (MIL), Specifications and Standards, current edition:
      a. Mil Std 461D -1993. Military Standard, Electromagnetic Interference Characteristics.
      b. Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.
   8. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS10-1993 - AC Generator sets.
   9. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL2200. The genset shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.
      b. UL6200. The entire control system of the generator set shall be UL6200 listed and labeled.

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1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated stand-by power system, the work specified in the following sections shall be included under the scope this section:
   1. Section 26 36 00 - Transfer Switches

B. Provide factory assembled generator set equipment complete with digital electronic controls.

C. Engine Generator shall be furnished and installed in a Level 1 factory installed sound-attenuating enclosure suitable for exterior mounting with twenty-four hour sub-base fuel tank and installed on exterior concrete pad.

D. Provide factory test, equipment startup by a manufacturer-authorized technician, and on-site testing of the system.

E. The generator set manufacturer shall warrant all equipment provided under this section so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

F. Stationary emergency engine generator shall be furnished and installed with all regulatory certifications as required and shall comply with all applicable emissions regulations in force at the time of purchase. Unit shall not require additional field certifications to be performed by the owner.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated manual for the stand-by power system. Include information in accordance with the requirements specified under Section 26 36 00 - Transfer Switches.

C. Submit the following information specifically for engine generators:
   1. Manufacturer's product literature and performance data, sufficient to conformance with specification requirements.
   2. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
   3. Manufacturer certification of prototype testing.
   4. Manufacturer published warranty documents.
   5. Shop drawings showing plan and elevation views with certified overall dimensions and conduit connection details.
   6. Interconnection wiring diagrams showing all external connections required, with field wiring terminals marked in a consistent point-to-point manner.
   7. Manufacturer published installation instructions.
   8. Emissions Certifications. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary non-emergency application.
   9. Generator Sizing Calculations illustrating compliance with the load starting requirements identified in schedule.

1.05 FACTORY TESTING

A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. Provide a certified test report. Fully test equipment for function and performance at the factory.

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B. Perform generator set factory tests at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup, and function of safety shutdowns.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the stand-by power system. Include information in accordance with the requirements specified under Section 26 36 00 - Transfer Switches.

C. Submit the following information specifically for engine generators:
1. Submit final revised shop drawings incorporating any modifications made because of installation, start-up, operational testing, or for any other cause.
2. Submit results of all field-testing and corrective actions taken for all operational parameters.
3. Submit manufacturer's standard operation & maintenance information including installation manuals and safety instructions.
4. Submit contact list identifying names, addresses, telephone numbers, and any additional contact information for each equipment service organization involved with the Standby Engine/Generator Set.
5. Submit detailed operation and maintenance procedures for each major equipment item; include description of operation for all modes of operation, routine maintenance procedures, and trouble-shooting guide.
6. Submit listing spare parts provided under this contract and of recommended additional spare parts not provided under this contract along with costs.

1.07 QUALITY ASSURANCE

A. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

B. All materials, equipment, and parts shall be new and unused of current manufacture.

C. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

D. The Standby Engine/Generator Set manufacturer shall have been engaged in the manufacture of generator sets for a minimum of ten years and shall have a factory trained service and parts organization located within one hundred miles of the jobsite.

E. All control equipment shall be the standard product of the engine/generator set manufacturer. Controls systems supplied by a subcontractor of the manufacturer and not incorporated into the standard documentation of the manufacturer will not be acceptable.

1.08 WARRANTY

A. Warrant the generator set and associated equipment for a period of not less than five years from the date of Start-up against defects in materials and workmanship.

B. The warranty shall be comprehensive with no deductibles allowed for travel time, service hours, repair parts cost, etc.

C. The manufacturer of the generator set shall maintain service parts inventory at a central location that is accessible to the service location twenty-four hours per day, three hundred sixty-five days per year.

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D. A local service organization that is factory trained and certified in generator set service shall service the generator set. The service organization shall maintain an inventory of critical replacement parts. The service organization shall be on call twenty-four hours per day, three hundred sixty-five days per year.

E. The manufacturer shall maintain model and serial number records of each generator set provided for at least twenty years.

1.09 EXTRA MATERIALS

A. Provide supply of consumables (air cleaner, oil filter, etc.) in sufficient quantity to last for one year from the date of substantial completion.

1.10 DESIGN REQUIREMENTS

A. Engine Generator Schedule of Requirements:
   1. Tag: 30-G-1.
      a. Minimum kW/kVA Rating: 80 kW / 100 kVA.
      b. Minimum Starting kVA: 275 kVA.
      c. Minimum Engine Displacement: V-8 CYL / 6.2 L.

B. Generator Load List:
   1. Step 1:
      a. Qty. (1) Misc. Linear Load - 480VAC, 3Ø, 15 kW.
      b. Qty. (1) Misc. Linear Load - 480VAC, 3Ø, 13.3 kW.
   2. Step 2:
      a. Qty. (1) Motor - 480VAC, 3Ø, 25 HP, AFD with Filtering.
   3. Step 3:
      a. Qty. (1) Motor - 480VAC, 3Ø, 25 HP, AFD with Filtering.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers
   1. Kohler Power Systems.
   2. Cummins/Onan.
   3. Caterpillar/Olympian.

B. The first named manufacturer is the basis for these specifications, the installation design, the heating/ventilation design, and the fuel system design. If the contractor elects to supply equipment of another named manufacturer, then the contractor shall be responsible for adjusting the installation of the standby engine/generator set to satisfy the requirements of that manufacturer's equipment.

C. The Engineer will only consider equipment of manufacturers, other than those named, as an alternate in accordance with the requirements of Division 1. The following information shall be submitted prior to acceptance of alternate equipment:
   1. Certified dimensional data.
   2. Verification of adequate cooling/combustion air for the installation.
   3. Complete interconnecting wiring and piping diagrams.
   4. Manufacturer certification of prototype testing.
   5. Load study/profile showing non-overloading of genset under steady-state conditions and during motor starting.
   6. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
   7. A paragraph-by-paragraph listing of exceptions to the specifications, describing the differences between the specified and the proposed equipment.

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8. Short circuit study of the load circuits to verify that selective coordination occurs and that thermal-magnetic stresses on components will not exceed the specified ratings.
9. Listing of similar projects and owner contact information for projects completed during the previous five years.

2.02 GENERATOR SET

A. Ratings
1. The generator set shall operate at 1800 rpm and at the scheduled voltage.
2. The generator set shall be provided with the scheduled, rated output capacity at 0.8 PF, based upon an altitude of 1000 feet and an ambient temperature of 100 degrees F.
3. Base generator set ratings upon emergency/standby service.
4. Generator shall be equipped with 12-lead alternator suitable for use with a 480/277V, 3-phase, 4-wire system.

B. Performance
1. Voltage regulation shall be +/-1.0 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed +/-1.0 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed +/-0.5 percent.
3. The engine-generator set shall be capable of single step load pick up of 100 percent nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Minimum motor starting capability shall be as scheduled.
5. Motor starting capability shall be adequate to start the specified loads with an instantaneous voltage dip of less than 15 percent.
6. Motor starting capability shall be adequate to start the specified loads with an instantaneous frequency dip of less than 10 percent.
7. The Gen-Set shall be sized to start and run the scheduled loads assuming scheduled miscellaneous load and stepped motor starts.
8. The alternator shall produce a clean AC voltage waveform, with not more than 5 percent total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3 percent in any single harmonic.
9. Telephone influence factor shall be less than 50.

C. Construction
1. Mount the engine-generator set on heavy-duty steel base and maintain alignment between components. The base shall incorporate a corrosion resistant battery tray with hold-down clamps within the rails for generators smaller than 750KW. For generators 750KW and larger the base shall incorporate a corrosion resistant battery tray with hold-down clamps outside of the skid rails.
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control panel (with the door open) that operate in excess of 50 volts.

D. Connections
1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations for the number and type cables shown on the drawings. Provide suitable lugs and termination space for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at the power distribution panel as shown on the drawings.
3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

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2.03 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be Natural Gas fueled, 4 cycle, radiator and fan cooled. Minimum displacement and number of cylinders shall be as scheduled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable.

B. Accessories and features
1. Complete engine fuel system, including all pressure regulators, strainers, and control valves. Plumb the fuel system to the generator set skid for ease of site connections to the generator set.
2. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Regulate fuel rate as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.
3. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet, based on 0.5 in-H2O external static head. Size radiator based on a core temperature that is 20 degrees F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Provide radiator with a flexible duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Guard rotating parts against accidental contact.
4. Electric starter(s) capable of three complete cranking cycles without overheating.
5. Positive displacement, mechanical, full pressure, lubrication oil pump. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
6. Replaceable dry element air cleaner with restriction indicator. Flexible fuel supply lines.
7. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.
8. Coolant heater
    a. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the contract drawings. The coolant heater shall be UL499 listed and labeled.
    b. Connect the coolant heater to the engine with silicone hose connections. Use steel tubing for connections into the engine coolant system wherever the length of pipe exceeds 12 inches. Specifically design the coolant heater installation to provide proper venting of the system. Install coolant heater(s) using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow replacement of the heater element without draining the engine cooling system or significant coolant loss.
    c. Provide a 24 VDC thermostat for the coolant heater and install at the engine thermostat housing. Factory wire the coolant heater system to an AC power connection box allowing for a single AC power connection.
    d. Size the coolant heater(s) as recommended by the engine manufacturer to warm the engine to a minimum of 100 degrees F in a 40 degree F ambient enclosure, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.
9. Alternator strip heater. Battery heater.
10. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
11. Starting and Control Batteries shall be calcium/lead antimony type, 12 or 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.

2.04 AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly

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connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees C.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. Generator shall be reconnectable to operate at various voltage levels.

D. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single-phase or three-phase fault at approximately 300 percent of rated current for not more than 10 seconds.

E. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.05 ENGINE GENERATOR SET CONTROL

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

B. The generator set mounted control shall include the following features and functions:
   1. Control Switches
      a. Mode Select Switch: The mode select switch shall initiate the following control modes. When in the RUN position the generator set shall start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position, the generator set shall accept a signal from a remote device to start and accelerate to rated speed and voltage.
      b. EMERGENCY STOP switch: Switch shall be red "mushroom-head" push-button. Depressing the emergency stop switch shall immediately shut down the generator set, and prevent automatic restarting.
      c. RESET switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
      d. PANEL LAMP switch: The panel lamp switch shall illuminate all panels for ten minutes or until the switch is depressed a second time.
   2. Generator Set AC Output Metering
      a. Analog AC Voltmeter, dual range, 90 degree scale, 2% accuracy; Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy; Analog Frequency/RPM meter, 45-65 Hz, 1350-1950 RPM, 90 degree scale, +/- 0.6 Hz accuracy.
      b. Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. When supplied with re-connectable generators, the meter panel shall be re-connectable for the voltage specified.
   3. Generator Set Alarm and Status Display
      a. Provide alarm and status indicating lamps to indicate non-automatic generator status, warning, and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
         1) Low oil pressure (alarm).
         2) Low oil pressure (shutdown).
         3) Oil pressure sender failure (alarm).
         4) Low coolant temperature (alarm).

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5) High coolant temperature (alarm).
6) High coolant temperature (shutdown).
7) Engine temperature sender failure (alarm).
8) Low coolant level (alarm or shutdown-selectable).
9) Fail to crank (shutdown).
10) Fail to start/overcrank (shutdown).
11) Over speed (shutdown).
12) Low DC voltage (alarm).
13) High DC voltage (alarm).
14) Weak battery (alarm).
15) Low fuel (alarm).
16) High AC voltage (shutdown).
17) Low AC voltage (shutdown).
18) Under frequency (shutdown).
19) Over current (warning).
20) Over current (shutdown).
21) Short circuit (shutdown).
22) Over load (alarm).
23) Emergency stop (shutdown).
24) Make provisions for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions.
25) The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

4. Engine Status Monitoring
   a. The following information shall be available from a digital status panel on the generator set control:
      1) Engine oil pressure (PSI or kPA).
      2) Engine coolant temperature (degrees F or C).
      3) Engine oil temperature (degrees F or C).
      4) Engine speed (rpm).
      5) Number of hours of operation (hours).
      6) Number of start attempts.
      7) Battery voltage (DC volts).
      8) The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
5. Engine Control Functions
   a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for three cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
   b. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
   c. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
   d. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature that is capable of discriminating between failed sender or wiring components, and actual failure conditions.
6. Alternator Control Functions
   a. The generator set shall include an automatic digital voltage regulation system matched and prototype tested with the governing system provided. It shall be immune from failure due to load-induced voltage waveform distortion and shall provide a pulse width

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modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

b. Monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110 percent of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator. The protective functions provided shall comply with the requirements of NFPA70 article 445.

c. Individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall comply with the requirements of NFPA70 article 445.

d. Monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a set of dry contacts for load-shed control.

e. Provide an AC over/under voltage monitoring system that responds only to true RMS voltage conditions. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110 percent of the operator-set voltage level for more than 10 seconds or with no intentional delay when voltage exceeds 130 percent. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85 percent for more than 10 seconds.

f. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. Disable the low voltage limit during engine starting. If DC voltage drops to less than 14.4 volts for more than two seconds during cranking, initiate "weak battery" alarm.

7. Control Interfaces for Remote Monitoring

a. Terminate all generator set control and interconnection points to remote components in a separate connection box. Do not make field connections in the control enclosure or in the AC power output enclosure.

b. Form "C" dry common alarm contact set rated 2A/30VDC to indicate existence of any alarm or shutdown condition on the generator set.

c. Form "C" dry generator run contact set rated 2A/30VDC to indicate existence of generator run condition.

C. Provide a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

D. Provide a mounted main line circuit breaker, sized to carry the rated output current of the generator set on a continuous basis. The circuit breaker shall incorporate an electronic trip unit. The supplier shall submit time over current characteristic curves for the breaker.

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E. Sequence of Operation
1. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set.
2. The generator set shall complete a time delay start period as programmed into the control.
3. The generator set control shall initiate the starting sequence for the generator set.
a. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.
b. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.
c. The engine shall accelerate to rated speed and the alternator to rated voltage.
4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.
5. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
6. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

2.06 ENGINE EXHAUST SYSTEM

A. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer along with all necessary appurtenances. The exhaust silencers shall be critical grade.

B. Engine exhaust system not factory installed on the generator skid shall be field installed. Coordinate exact requirements with installing contractor.

C. Provide stainless steel, seamless flexible exhaust manifold connector.

2.07 NATURAL GAS ENGINE FUEL SYSTEM

A. The mechanical contractor shall provide fuel-piping system.

B. Provide appropriately sized fuel regulator.

C. Engine fuel consumption shall not exceed 1915 cfh at a pressure of 7-13 inches of water column. Minimum fuel pipe size of as recommended by manufacturer.

2.08 OUTDOOR WEATHER-PROTECTIVE HOUSING

A. The generator set shall be provided with a Level 1 factory installed sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. Housing configuration and materials used may be of any suitable design which meets application needs. Do not use foam materials unless demonstrated to have the same durability and life as fiberglass.
1. Sound pressure shall be 71 dBA or less as measured at 23 feet from enclosure at full load.

B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Provide key-locking and pad-lockable door latches for all doors. Door hinges shall be stainless steel.

C. All enclosure accessories shall be protected with lockable vandal resistant guards and all access doors shall be lockable.

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D. Any openings in the generator enclosure shall be sealed with rodent resistant screens.

E. Provide generator set housing factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:
1. Primer thickness, 0.5-2.0 mils. Topcoat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523-89, 80+/-5 percent. Gloss retention after one year shall exceed 50 percent.
3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
5. Salt Spray, per ASTM B117-90, 4000+ hours.
6. Humidity, per ASTM D2247-92, 1000+ hours.
7. Water Soak, per ASTM D2247-92, 1000+ hours.

F. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

G. Louvers shall be provided for cooling air inlet and discharge. They shall be stormproof and drainable to prevent entry of rain and snow. The louvers shall be automatic for the cooling-air inlet and discharge. The dampers shall be closed to reduce enclosure heat loss and maintain 40 degree Fahrenheit in the enclosure in cold weather when the unit is not operating. Provide 120-volt, 20 amp circuit for these louvers

H. Provide supplemental heater in enclosure to maintain 40 degrees Fahrenheit in enclosure during cold weather period of the year

I. Provide the basic electrical package enclosure with the following equipment:
1. All electrical loads in Generator enclosure shall be wired from a remote lighting panel. This includes internal lighting, three-way switching, and GFI receptacle. All auxiliary circuits as shown on the plans shall be wired to the remote lighting panel.
2. 120VAC single-phase block heater.
3. Battery charger.
    a. The battery charger shall be a float type charger rated 6 amps minimum. Display supply power failed indication on the genset and on the remote annunciator panel.

2.09 EMERGENCY STOP PUSHBUTTON

A. Provide a weatherproof emergency stop pushbutton meeting NFPA requirements.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify with exact measurements, the available mounting space for standby power system equipment. Identify deficiencies prior to beginning installation.

3.02 DELIVERY, STORAGE, AND HANDLING

A. It shall be the responsibility of the installing contractor to receive all standby power system equipment at the job site. Carefully inspect all equipment for damage prior to accepting from the shipping agency. Do not accept shipment if damage is evident.

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B. Exercise due diligence in storing, protecting, and moving standby power system equipment. Damaged or worn equipment will not be accepted and will be replaced at no additional cost to the Owner.

3.03 INSTALLATION

A. Install equipment in locations as indicated on the contract documents. Adjust locations as needed to ensure operability, serviceability, and compliance with all applicable codes and standards.

B. Completely test installation prior to start-up. This work includes verification of all field wiring continuity and proper termination of wiring.

C. The contractor shall install equipment in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

D. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

E. Installation of equipment shall include furnishing and installing all fuel piping, vent piping, and appurtenances as required. The tank installer shall perform this work under the supervision of the equipment supplier.

F. Installation of equipment shall include furnishing and installing all exhaust piping and and appurtenances as required. The contractor shall perform this work under the supervision of the equipment supplier.

G. Install equipment on concrete housekeeping pads. Permanently fasten equipment to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

H. Representatives of the manufacturer shall be initially start and operate equipment.

I. Physically inspect all equipment for damage. Repair scratches and other installation damage prior to final system testing. Thoroughly clean equipment and remove all dirt and construction debris prior to final testing of the system.

3.04 TESTING AND START-UP SERVICES

A. Standby power system supplier shall provide installation and start-up services required to place the complete system into operation.

B. Test the complete installation for compliance with the specifications following completion of all site work. Representatives of the manufacturer shall conduct testing, with required fuel supplied by Contractor. Notify the Engineer in advance of the tests to allow the option of witnessed tests.

C. Installation acceptance tests to be conducted onsite shall include a "cold start" test, a two-hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test. Provide all required cables and make accommodations for routing of cables to allow load bank to be located outside of the building.

D. Perform a power failure test on the entire installed system. Conduct test by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

E. Test alarm and shutdown circuits by simulating conditions.

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F. Adjust output voltage and engine speed.

G. Record kW, Amps, Volts, Frequency, oil pressure, coolant temperature, and room temperature at twenty-minute intervals during the test and report findings to Engineer in writing.

H. Verify operation of room ventilation system including interlocks with generator equipment.

I. Verify fuel system installation and capacity.

3.05 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

B. Describe the loads connected to the standby power system along with restrictions for future use. Coordinate this discussion with the process instrumentation control system integrator and include automatic step start control and load control.

C. Provide for one technician follow up visit to installation site one month after commissioning to consult with Owner, verify correct operation of standby system, and make any required corrections, adjustments, repairs, etc.

D. Identify record-keeping and reporting requirements for emissions regulations.

PART 4 MEASUREMENT AND PAYMENT

4.01 IDENTIFICATION FOR ENGINE GENERATORS

A. Identification for Engine Generators shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Identification for Engine Generators, Lump Sum. When so provided, payment for Identification for Engine Generators shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Identification for Engine Generators, Inclusive. When no quantity is provided, Identification for Engine Generators shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 36 00
TRANSFER SWITCHES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA20 - Fire Pumps. Transfer switches serving fire pumps shall be specifically listed and labeled for that application.
      b. NFPA70 - National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
      c. NFPA99 - Essential Electrical Systems for Health Care Facilities.
      d. NFPA110 - Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
   2. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, No. 14 - M91 Industrial Control Equipment.
      b. CSA 282, 1989 Emergency Electrical Power Supply for Buildings.
   3. European Committee for Electrotechnical Standardization (CENELEC), Specifications and Standards, current edition:
      a. EN55011, Class B Radiated Emissions.
      b. EN55011, Class B Conducted Emissions.
   4. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity.
      b. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity.
      c. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity.
      d. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity. Similar waveforms are described in ANSI/IEEE 62.41-1991.
      e. IEC 1000-4-6 Conducted Field Immunity.
      f. IEC 1000-4-11 Voltage Dip Immunity.
   5. Institute of Electrical and Electronics Engineers, Specifications and Standards, current edition:
      a. IEEE446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
   6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS10-1993 - AC Automatic Transfer Switches.
   7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL1008. The transfer switch shall be UL listed and labeled.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated stand-by power system, the work specified herein shall be included under the scope of:
   1. Section 26 32 10 - Engine Generators

B. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles internal to transfer switch enclosure, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

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C. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system. Technicians specifically trained to support the product and employed by the generator set supplier shall service the transfer switches.

D. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for all the products provided.

E. The automatic transfer switch specified herein shall be equipped with a time delay in the neutral position (programmed transition). Alternative methods for transfer control are not acceptable.

F. Transfer Switch shall be furnished and installed in a factory NEMA 12 steel enclosure suitable for interior mounting. Enclosure shall be lockable and completely secure all control operators.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the stand-by power system and in accordance with the requirements specified under Section 26 32 10 - Engine Generators.

C. Submit the following information specifically for transfer switches:
1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
2. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
3. Manufacturers published warranty documents.
4. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
5. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
6. Manufacturer's installation instructions.

1.05 FACTORY TESTING

A. The generator set supplier shall perform a complete operational test on the automatic transfer switch prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Test process shall include calibration of voltage sensors.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the stand-by power system and in accordance with the requirements specified under Section 26 32 10 - Engine Generators.

C. Submit the following information specifically for transfer switches:
1. Submit final revised shop drawings incorporating any modifications made as a result of installation, start-up, operational testing, or for any other cause. Submit results of all field-testing and corrective actions taken for all operational parameters.
2. Submit manufacturers standard operation & maintenance information including installation manuals and safety instructions.

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3. Submit contact list identifying names, addresses, telephone numbers, and any additional contact information for each equipment service organization involved with the Standby Engine/Generator Set.
4. Submit detailed operation and maintenance procedures for each major equipment item; include description of operation for all modes of operation, routine maintenance procedures, and trouble-shooting guide.
5. Submit listing spare parts provided under this contract and of recommended additional spare parts not provided under this contract along with costs.

1.07 QUALITY ASSURANCE

A. The Automatic Transfer Switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

B. All materials, equipment, and parts shall be new and unused of current manufacture.

C. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

D. The Automatic Transfer Switch manufacturer shall have been engaged in the manufacture of generator sets for a minimum of ten years and shall have a factory trained service and parts organization located within 100 miles of the jobsite.

E. All control equipment shall be the standard product of the engine/generator set manufacturer. Controls systems that are supplied by a subcontractor of the manufacturer and which are not incorporated into the standard documentation of the manufacturer will not be acceptable.

1.08 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than five years from the date of start-up against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

C. The manufacturer of the transfer switch shall maintain service parts inventory at a central location that is accessible to the service location twenty-four hours per day, three hundred sixty-five days per year.

D. The ATS shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call twenty-four hours per day, three hundred sixty-five days per year.

E. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least twenty years.

1.09 EXTRA MATERIALS - NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The automatic transfer switch shall be provided as part of a complete, integrated standby power system. As such, the manufacturer of the Standby Engine/Generator Set shall provide it.

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2.02 POWER TRANSFER SWITCH

A. Ratings
   1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
   2. Main contacts shall be rated for 600 Volts AC, minimum.
   3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95 percent (non-condensing), and altitudes up to 10,000 feet (3000M).
   4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings and at the specified voltage. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

B. Construction
   1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
   2. All ATS's shall have manual operators for service use only de-energized. Provide keyed switch, AUTO-MANUAL-TRANSFER to allow for manual operation while door remains closed.
   3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
   4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
   5. Transfer switches designated as 4-pole switches on the drawings shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.
   6. Transfer switches designated as 3-pole switches on the drawings shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100 percent of the current designated on the switch rating.

C. Connections
   1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
   2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

2.03 TRANSFER SWITCH CONTROL

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions.

B. Operator panel and features and capabilities shall include:
   1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

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2. High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch (when used) enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.
3. “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
4. “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
5. “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool or an operator display panel.
7. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
    a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.
    b. Display source status, to indicate source is connected or not connected.
    c. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
        1) Calibrate ATS to match utility nominal voltage and frequency for the transfer switch.
        2) Adjust voltage and frequency sensor operation set points.
        3) Set up time clock functions.
        4) Set up load sequence functions.
        5) Enable or disable control functions in the transfer switch, including program transition.
        6) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
    d. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
    e. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
    f. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, network communications error.

C. Internal Controls
1. The transfer switch control system shall be field-configurable for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within +/-1 percent of nominal voltage level. Frequency sensing shall be accurate to within +/-0.2 percent. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field-configurable are not acceptable.
2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
    a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98 percent of the normal voltage level and dropout in a range of 75 to 98 percent of normal voltage level).

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b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98 percent of the normal voltage level and dropout in a range of 75 to 98 percent of pickup voltage level).

3. All transfer switch sensing shall be configurable from a Microsoft Windows PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool down) (adjustable in a range of 0-30 minutes).
6. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
7. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
8. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

D. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
3. One set of contacts rated 2A/30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90 percent of rated condition.
4. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.

2.04 ENCLOSURE

A. Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.

B. Transfer Switch shall be furnished and installed in a factory NEMA 12 steel enclosure suitable for interior mounting. Enclosure shall be lockable and completely secure all control operators.

C. Where provided manual operating handles and all control switches shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or control switches located on outside of cabinet do not meet this specification and are not acceptable.

2.05 OPERATION

A. Sequence of Operation

1. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.
2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

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a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set.
c. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
d. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the load to the normal service.
e. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
f. The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:
a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set and cause the generator set to start and accelerate to rated voltage and frequency.
c. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
d. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify with exact measurements, the available mounting space for standby power system equipment. Identify deficiencies prior to beginning installation.

3.02 DELIVERY, STORAGE, AND HANDLING

A. It shall be the responsibility of the installing contractor to receive all standby power system equipment at the job site. Carefully inspect all equipment for damage prior to accepting from the shipping agency. Do not accept shipment if damage is evident.

B. Exercise due diligence in storing, protecting, and moving standby power system equipment. Damaged or worn equipment will not be accepted and will be replaced at no additional cost to the Owner.

3.03 INSTALLATION

A. Install equipment in locations as indicated on the contract documents. Adjust locations as needed to ensure operability, serviceability, and compliance with all applicable codes and standards.

B. Installation shall be completely tested prior to start-up. This work includes verification of all field wiring continuity and proper termination of wiring.

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C. The contractor shall install the equipment in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

D. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

E. Equipment shall be initially started and operated by representatives of the manufacturer.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.04 TESTING AND START-UP SERVICES

A. Standby power system supplier shall provide installation and start-up services required to place the complete system into operation.

B. The complete installation shall be tested for compliance with the specification following completion of all site work. Representatives of the manufacturer shall conduct testing, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

C. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two-hour full load test, and a one step rated load pickup test in accordance with NFPA 110.

D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

E. Test all control functions by simulating conditions.

F. Provide for one technician follow-up visit to installation site one month after commissioning to consult with Owner, verify correct operation of standby system, and make any required corrections, adjustments, repairs, etc.

3.05 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided as part of the owner training session specified under Standby Engine Generator Set.

PART 4 MEASUREMENT AND PAYMENT

4.01 IDENTIFICATION FOR TRANSFER SWITCHES

A. Identification for Transfer Switches shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Identification for Transfer Switches, Lump Sum. When so provided, payment for Identification for Transfer Switches shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Identification for Transfer Switches, Inclusive. When no quantity is provided, Identification for Transfer Switches shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 00
PROCESS INSTRUMENTATION & CONTROL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. ANSI/ISA-5.1-1984 - Instrumentation Symbols and Identification .
      b. ANSI/ISA-5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
      c. ANSI/ISA-95.00.01-2000 - Enterprise Control System Integration, Part 1: Models and Terminology.
      d. ANSI/ISA-TR99.00.01-2004, Security Technologies for Manufacturing and Control Systems.
      e. ANSI/ISA-TR99.00.02-2004, Integrating Electronic Security into the Manufacturing and Control Systems Environment.
   2. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA 70 - National Electrical Code.
   3. CE - European Community, Applicable Directives.
      a. EN50005 - for Terminal Markings.
      b. EN50081-1- Generic Emission Standard.
      c. EN50082-1 - Generic Immunity Standard.
      d. EN61000-4-4 - Electromagnetic compatibility (EMC). Testing and measurement techniques.
      e. EN61000-4-5 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
   4. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, Industrial Control Equipment.
   5. CUL - Underwriter's Laboratories of Canada.
   6. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC 60529 - Classification of Degrees of Protection Provided by Enclosures
   7. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
      b. NEMA ICS 3 - Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC.
   8. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL508 - Industrial Control Equipment.
      b. UL508A - Industrial Control Panels.
      c. UL 913 - Intrinsically Safe Specification.
      d. UL94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated Process Instrumentation and Control System, the following sections shall be included under the scope of this section:
   1. Section 26 29 23 - Adjustable Frequency Motor Controllers

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2. Section 26 90 10 - Control Panel Construction
3. Section 26 90 11 - Control Panel Components
4. Section 26 90 20 - Instrumentation Devices
5. Section 26 90 30 - Programmable Logic Controllers
6. Section 26 90 41 - License-Free Spread Spectrum Ethernet Radio Equipment
7. Section 26 90 50 - SCADA System Hardware
8. Section 26 90 60 - Ethernet Networking Equipment

B. The work specified herein shall include the furnishing of all materials, equipment, labor, and supervision necessary to fabricate, install, start-up, and test a complete and operable Process Instrumentation and Control System.

C. The labor specified herein includes but is not limited to engineering, software development, panel fabrication, equipment calibration and adjustment, testing, training, and documentation.

D. This section identifies the overall functional requirements for the Process Instrumentation and Control System.

E. This section includes coordination with the work of other sections. This work includes identification of exact interface requirements with motors, control panels, and field instrumentation provided under other portions of this specification. It shall be the responsibility of the system integrator specified under this section to execute this coordination during the shop drawing submittal phase of the work. Additional costs due to inadequate coordination as required herein shall be borne solely by this contractor.

F. This section includes coordination with electrical contractor to ensure that the proper number of raceways and conductors are installed. It shall be the responsibility of the system integrator to coordinate this work with the installing electrician. Additional costs due to inadequate coordination as required herein shall be borne solely by this contractor.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit the following information specifically for process instrumentation and control system:
1. General requirements specific to this section include:
   a. Submit complete and integrated document containing all equipment included under the scope of this section.
   b. Submittal shall be complete, neat, orderly, and indexed with tabbed dividers. Partial submittals will not be accepted.
   c. Include a complete list of proposed exceptions to and deviations from these specifications.
   d. Clarity and completeness are of prime importance. Acceptability of submittal drawings shall be at the sole discretion of the Engineer in regards to this requirement.
   e. Additional requirements for the various subsystems are specified in the corresponding sections.
2. Submit the following information:
   a. Bill of Materials:
      1) Complete listing of all components identifying exact make and model, quantity, and description.
   b. Component Data Sheets:
      1) Detailed listing for each type of device, identifying Engineer's tag number, manufacturer, model, options, ranges, and other information necessary to supplement component catalog cut sheets and clearly show compliance with these specifications.
   c. Component Catalog Cut sheets:
      1) Manufacturer's standard catalog information.
   d. Control Panel Construction Drawings:

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1) Scaled drawings of all control panels and enclosures.
2) Front panel elevation complete with nameplate legend.
3) Back panel elevation complete with schedule of devices.

e. Control Panel Schematic Wiring Diagrams:
1) Ladder type schematic diagrams.
2) Show all devices requiring electrical connections.
3) Identify all wire and terminal numbers.
4) Identify PLC I/O addresses.
5) Reference Engineer's tag number where assigned.
6) Cross-reference all relay contacts and coils.
7) Identify switching action on all switching devices.
8) Common diagrams will not be accepted.

f. Analog Loop Diagrams:
1) Show all devices requiring electrical connections.
2) Identify all wire and terminal numbers.
3) Identify PLC I/O addresses.
4) Identify location of loop power supply.
5) Identify field devices, back-of-panel devices, and front-of panel devices.
6) Show tabular summary of transmitter output capability, input impedance of each receiver, total loop impedance, and reserve output capacity.
7) Reference Engineer's tag number where assigned.
8) Common diagrams will not be accepted.

g. Control Panel Plumbing Diagrams:
1) Show all devices requiring plumbing connections (air or liquid).
2) Show pipe/tube sizing.
3) Show all control devices (valves, regulators, filters, etc.).

h. Control Panel Power and Environmental Requirements:
1) Identify voltage and ampacity requirements.
2) Show sizing calculations for environmental controls (ventilation, heat, air conditioning).

i. Interconnecting Wiring Diagrams:
1) Show all interconnections between control panels.
2) Show all interconnections between control panels and motor control centers.
3) Show all interconnections between control panels and field devices.
4) Show all interconnections between motor control centers and field devices.
5) Identify all wire and terminal numbers, including field terminal junction box terminals.

j. Control Device Installation Details:
1) Supplement contract documents with additional details necessary for proper installation of control devices.

k. Configuration Documentation:
1) Submit complete, documented configuration data for all configurable controllers.
2) Additional requirements for PLC systems and PC based SCADA systems are identified in the individual subsystem sections.

1.05 FACTORY ACCEPTANCE TESTING, SYSTEM STRATUP, AND SUPPORT SERVICES

A. System Supplier shall assemble the SCADA System as a complete process monitoring and control system, including HMI Computers / Servers, SCADA Panels, MCC's, Drives, Telemetry Systems, and Alarming Systems where applicable. These Systems shall be demonstrated that the systems are operational before shipment to the project site. This testing shall be as an integrated assembly by simulating random specified I/O points and all specified Control Loops. This test shall be witnessed by Owner and/or Engineer. All problems, errors, insufficiencies, and failures identified during testing shall be resolved before shipment.

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1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit the following information specifically for process instrumentation and control system:
   1. Submit final revised shop drawings incorporating any modifications made as a result of factory test, installation, start-up, operational testing, or for any other cause. Submit results of all field-testing and corrective actions taken for all discrete control devices and for all analog control devices. Submit analog device calibration data sheets.
   2. Submit manufacturers standard operation & maintenance information including installation manuals and safety instructions.
   3. Submit contact list identifying names, addresses, telephone numbers, and any additional contact information for each equipment service organization involved with the Process Instrumentation and Control System.
   4. Submit detailed operation and maintenance procedures for each major equipment item; include description of operation for all modes of operation, routine maintenance procedures, and trouble-shooting guide.
   5. Submit listing spare parts provided under this contract and of recommended additional spare parts not provided under this contract along with costs.

C. Submit the following information specifically for the SCADA system on a jump drive or portable hard drive (not to be used for the back-up of the computers):
   1. A copy of all final PLC programs with documentation,
   2. A copy of all Panelview configuration files containing all windows / screens to allow for a complete recovery of the system,
   3. A copy of all HMI computer/ server images containing all windows / screens to allow for a complete recovery of the system from this image,
   4. A copy of all network switch configuration files,
   5. A list of all IP addresses, and passwords for all devices on the network.
   6. A list of all passwords for PLC code and blocks within PLC code.
   7. A copy of all Radio configuration files
   8. A copy of all Firewall configuration files
   9. A copy of all VFD and solid state overload configuration files

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 PRE-SUBMITTAL COORDINATION CONFERENCE

A. This project includes communication system interface between the work specified under this section and work specified under other sections. To facilitate the implementation of this interface a pre-submittal conference shall be held at the Owner's Facility or the Engineer's office, at which all parties will be present. The agenda of this conference shall include the following coordination items:
   1. Component standardization.
   2. PLC addressing.
   3. Control function requirements - functional description / control loop review.
   4. Operator interface requirements.

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5. Other interface/coordination issues.

1.09 ADDITIONAL REQUIRMENTS

A. System Integrator shall provide an additional 24 hours of programming time to provide additional functionality to the system that is not specified herein

1.10 WARRANTY

A. See Division 01 for additional requirements.

1.11 ADDITIONAL INFORMATION (NOT USED)

PART 2 PRODUCTS

2.01 SYSTEM INTEGRATOR

A. The system integrator shall be a firm specializing in the integration of control systems with documented experience in the detailed design, construction, configuration, and maintenance of PLC based control systems and motor control centers for the water/wastewater utility market. This experience must include a minimum of five projects similar in nature to this project during the last five years.

B. The system integrator shall have in-house capability to handle complete system engineering, control panel fabrication, instrument supply and calibration, commissioning, testing, and troubleshooting of the process instrumentation and control system

C. Approval of System Integration Firms for this Contract will not be granted prior to the bid. The Contractor will be required to submit system integrator evidence of qualifications after the bid and firms that are unable to document compliance with the following requirements will not be approved as the system integrator for this project.
   1. The system integration firm has completed projects for at least ten municipal customers, five of which must be similar in scope and approach to this project. For each project, provide owner's name, address, telephone number, and description of control system including major equipment items.
   2. To demonstrate financial stability, the system integration firm has completed a minimum of four past projects, each with an individual contract cost in excess of $500,000.
   3. To demonstrate technical capability, the system integration firm shall employ an engineering staff of not less than five engineers and technicians with a combined experience of no less than 50 years designing, constructing, and configuring process control systems.
      a. Submit a sample set of project drawings from a comparable project recently completed by the proposed system integration firm.
      b. Provide resumes of all key personnel:
         1) Project Manager: minimum of 5 years' experience providing, integrating, installing, and starting up similar systems as required for this project.
         2) Site Representative: minimum of 5 years' experience installing systems similar to those specified for this project.
   4. The system integration firm shall have an active $1,000,000 professional liability insurance policy.
   5. The system integrator shall be factory authorized to commission Drives, PLC's and MCC's, and to be an authorized Rockwell Strategic Provider with full development software to modify and create new applications in the specified HMI software.

D. Acceptable system integrators include:
   1. Base Bid: Telemetry & Process Controls, telephone number (651) 430-0435.
   2. Energenecs, Contact Keith Kohn, telephone number (262) 685-6506.
   3. Integrated Process Solutions, contact Eric Fisher, telephone number (608) 849-4375
   4. Quality Flow, telephone number (800) 227-5432
   5. No Exceptions

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2.02 RADIO SYSTEM SUPPLIER

A. The Radio System Supplier shall be a firm specializing radio systems with documented experience in the detailed design, construction, configuration, and maintenance of radio based control systems for the water/wastewater utility market. This experience must include a minimum of five projects similar in nature to this project during the last five years.

B. The Radio System Supplier shall have in-house capability to handle complete system engineering, fabrication, radio supply and configuration, commissioning, testing, and troubleshooting of the radio system

C. Acceptable Radio System Suppliers include:
   1. System Integrator
   2. Or Equal

2.03 GENERAL FUNCTIONAL DESCRIPTION

A. Summary of System Improvements
   1. PLC based control systems and/or SCADA system HMI workstations shall be provided at the following locations:
      a. STR-20 – PRV Station:
         1) Install a new PLC control panel, 20-PLC-1, which shall consist of an Allen-Bradley CompactLogix Ethernet processor, associated chassis, power supply, and I/O modules as scheduled on the drawings along with an Ethernet switch, unlicensed 900MHz Ethernet radio, surge arrestor for the antenna, 120VAC UPS, and an integral load center.
         2) The panel shall also include a manufacturer provided front-of-panel mounted pressure reducing valve controller, XCV-20-1-1, for control of the pressure reducing control valve at this structure.
         3) Provide a directional antenna mounted at the height and in the location determined by the radio path study for radio communications. PRV Station radio shall communicate with future Water Tower No.3 radio provided under a separate contract.
         4) This control panel shall be responsible for communicating with the SCADA system radio frequency network. The provided radio shall be compatible with the new radio system currently being installed. Polling for radio system shall be through the master PLC, not a computer.
         5) This control panel shall also communicate with front of panel mounted PRV controller, XCV-20-1-1. Provide Modbus TCP to Ethernet/IP protocol converter as shown on the plans to integrate XCV-20-1-1 with the SCADA system.
      b. STR-30 – North Booster Station:
         1) Install a new PLC control panel, 30-PLC-1, which shall consist of an Allen-Bradley CompactLogix Ethernet processor, associated chassis, power supply, and I/O modules as scheduled on the drawings along with an Ethernet switch, unlicensed 900MHz Ethernet radio, surge arrestor for the antenna, and 120VAC UPS.
         2) Provide a directional antenna mounted at the height and in the location determined by the radio path study for radio communications. North Booster Station radio shall communicate with the existing radio at Water Tower No.1.
         3) This control panel shall be responsible for communicating with the SCADA system radio frequency network. The provided radio shall be compatible with the new radio system currently being installed. Polling for radio system shall be through the master PLC, not a computer.
         4) This control panel shall also communicate with AFD-30-1-1 and AFD-30-1-2. Future communications include a third drive, AFD-30-1-3, and a future chlorine analyzer.

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5) Provide room for a future third booster pump when developing the SCADA graphics for the proposed two booster pumps at the North Booster Station. Do not configure the graphics for the future booster pump under this contract.
6) Provide the SCADA system functionality and graphics for the future chemical addition to the North Booster Station. Graphics shall be configured under this contract and put on a separate page from the rest of the North Booster Station graphics. The future chemical addition graphics shall be inaccessible until the future chemical addition is ready to be incorporated into SCADA.

c. Public Works & Wastewater Treatment Facility:
1) The master SCADA panel/computer is located at Public Works. The redundant SCADA panel/computer is located at the Wastewater Treatment Facility. Update the graphics and functionality at both locations to include new PRV Station and North Booster Station. All SCADA system graphical modifications and additions shall be reviewed and approved by the Owner and Engineer before field startup. All Owner feedback shall be incorporated.
2) Provide a Wi-Fi / cellular configured tablet for remote access into the existing SCADA system for local operator control.

d. SCADA Software License:
1) At the completion of this project, the current SCADA license shall have a minimum of 10% spare tags remaining. If less than 10% spare tags remain on the license, the System Integrator shall update the License to the next available tag count as required.

B. General Requirements:
1. The process instrumentation and control system consists of the following functional divisions which will be defined in detail for each loop under Detailed Functional Description:
a. General: includes a general overview of the work related with the specified loop.
b. Local Control Functions: includes local control panels, pilot control devices, instruments, and sensors.
c. SCADA System Control Functions: includes PLC hardware, interface devices, and PLC logic.
d. SCADA System Monitoring Functions: includes graphical user interface hardware and configuration, event monitoring and logging functions, analog parameter trending, and alarm handling.

C. Typical Motor Control Functions:
1. General:
a. Several standard motor control strategies are incorporated into this design and are described herein. Operator interface screens, configuration, and pilot device circuitry shall be similar for all motors of each type.
b. Type III Motor Control - Ethernet capable adjustable frequency drive.
2. Type III Motor Control - Ethernet capable, adjustable frequency drive.
a. Local Control Functions:
1) Local HAND-OFF-AUTO selector switch located on the adjustable frequency drive shall control motor operation.
(a) HAND Position: motor shall run continuously at speed preset on AFD.
(b) OFF Position: motor shall not run.
(c) AUTO Position: start and stop in response to the REQUIRED and Ethernet speed command signals.
2) Sensor provided under Division 44 shall detect MOTOR HIGH TEMPERATURE condition.

b. SCADA System Control Functions:
1) Graphical display HAND-OFF-AUTO selector (unless specified otherwise) shall control the REQUIRED signal.
(a) HAND Position: the signal shall be active and the SPEED COMMAND shall be manually input.
(b) OFF Position: the signal shall be inactive.

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(c) AUTO Position: the signal and the SPEED COMMAND shall be controlled by the automatic control strategy specified in the detailed functional description.

2) Provide MOTOR HIGH TEMPERATURE condition REMOTE RESET as described above.

3) Generate CALL-TO-RUN (CTR) FAIL alarm based on a discrepancy between MOTOR RUN and REQUIRED signals after an adjustable FAIL DELAY time has elapsed. CALL-TO-RUN FAIL condition shall prevent motor operation from the SCADA system until cleared and reset. CALL-TO-RUN FAIL shall only activate when SCADA SYSTEM CONTROL AVAILABLE is active.

4) Generate ABNORMAL CURRENT signal when motor average current falls below or rises above adjustable MINIMUM/MAXIMUM set points.

5) Generate COMMUNICATION FAIL alarm based upon a loss of communication with the motor AFD.

6) Provide additional functions as specified in the detailed functional description.

c. SCADA System Monitoring Functions:

1) Display the following status conditions: SCADA SYSTEM CONTROL AVAILABLE, REQUIRED, MOTOR RUN, AFD READY, AFD ALARM, AFD FAULT, AFD FAIL, COOLING FAN FAIL, MOTOR HIGH TEMPERATURE, ABNORMAL CURRENT, and MOTOR OVERLOAD.

2) Display, trend, and record the following parameters: AVERAGE CURRENT and PERCENT SPEED.

3) Incorporate into the alarm notification system and display the following alarm conditions: CALL-TO-RUN FAIL and COMMUNICATION FAIL.

4) Provide additional functions as specified in the detailed functional description.

d. SCADA System Historical Data Functions:

1) Display non-resettable runtime total.

2) Calculate, display, and record daily runtime total.

3) Calculate, display, and record number of daily starts.

4) Provide additional functions as specified in the detailed functional description.

2.04 UNIT PROCESS NO.20 – PRV STATION

A. Loop 20-1: Pressure Reducing Valve

1. General:

a. Pressure Reducing Valve WCV-20-1-1 is provided by another Division but must be wired and incorporated into SCADA system by Division 26.

1) WCV-20-1-1 shall bleed an operator settable amount of water daily from the high-pressure zone to the low-pressure zone.

b. Pressure Reducing Valve Controller XVC-20-1-1 is furnished by another Division but must be wired and incorporated into the SCADA system by Division 26.

1) SCADA is responsible for communicating with XVC-20-1-1. SCADA communication protocol is Ethernet/IP while XVC-20-1-1 communication protocol is Modbus TCP. Provide Modbus TCP to Ethernet/IP protocol converter as shown on the plans. Provide configurations of the protocol converter.

2) PRV Controller XVC-20-1-1 is responsible for operating WCV-20-1-1 pilot solenoids per SCADA requirements.

2. Local Control Functions:

a. WCV-20-1-1 provides an analog signal PRV STATION VALVE POSITION REFERENCE to XVC-20-1-1.

b. XVC-20-1-1 provides a discrete signal OPEN COMMAND to WCV-20-1-1.

c. XVC-20-1-1 provides a discrete signal CLOSE COMMAND to WCV-20-1-1.

d. XVC-20-1-1 shall be a front-of-panel mounted device on 20-PLC-1 and shall provide local control of WCV-20-1-1.

3. SCADA System Control Functions:

a. Graphical display OPEN-CLOSE-AUTO selector shall control the REQUIRED POSITION signal.

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1) MANUAL Position: XVC-20-1-1 provides REMOTE signal to SCADA.
2) OPEN Position: SCADA provides OPEN COMMAND to XVC-20-1-1.
3) CLOSE Position: SCADA provides CLOSE COMMAND TO XVC-20-1-1.
4) AUTO Position: SCADA provides appropriate commands to XVC-20-1-1 so that WCV-20-1-1 bleeds an operator settable amount of water from the high-pressure zone to the low-pressure zone at an operator settable time-of-day.

b. Automatic control of XVC-20-1-1 shall be interlocked with WATER TOWER NO.3 LOW TOWER LEVEL alarm to prevent WCV-20-1-1 from emptying Water Tower No.3. Water Tower No.3 and associated system integration is provided under a separate contract.

c. Generate PRV STATION VALVE FAIL signal based on discrepancies between PRV STATION VALVE REQUIRED POSITION signal and PRV STATION VALVE POSITION REFERENCE signal after an adjustable time delay.

4. SCADA System Monitoring Functions:

a. Display, trend, and record the following parameters:
1) PRV STATION VALVE POSITION REFERENCE
2) PRV STATION VALVE REQUIRED POSITION

b. SCADA System Alarming:
1) PRV STATION VALVE FAIL

c. SCADA System Historical Data Functions:
1) Incorporate PRV STATION POSITION REFERENCE into historical data display, logging, and trending.

B. Loop 20-2: Flow Monitoring / Control

1. General:

a. Bidirectional magnetic flow meter shall monitor the flow rate of low to high pressure flow and high to low pressure flow at the PRV Station. Additionally, the flow meter shall measure total flow at the PRV Station.

b. Bidirectional magnetic flow meter FE/FIT-20-2-1 is furnished by another Division but must be wired and incorporated into the SCADA system by Division 26.

2. Local Control Functions:

a. Flow meter/transmitter provides analog signal PRV STATION FORWARD FLOW RATE (valve pressure reducing option) to SCADA.

b. Flow meter/transmitter provides analog signal PRV STATION BACKWARD FLOW RATE (valve pressure sustaining option) to SCADA.

c. Flow meter/transmitter provides pulse signal PRV STATION FLOW TOTAL to SCADA.

3. SCADA System Control Functions:

1) AUTO Position: SCADA provides appropriate commands to XVC-20-1-1 so that WCV-20-1-1 bleeds an operator settable amount of water from the high-pressure zone to the low-pressure zone at an operator settable time-of-day.

b. Flow meter/transmitter shall be incorporated into the automatic control strategy referenced in 2.04.A.3.a.4.

4. SCADA System Monitoring Functions:

a. Display, trend, and record the following parameters:
1) PRV STATION INSTANTENEOUS FLOW RATE
2) PRV STATION FLOW DIRECTION
3) PRV STATION FLOW TOTAL

b. SCADA System Alarming: None.

c. SCADA System Historical Data Functions:
1) PRV STATION FLOW RATE
2) PRV STATION TODAY'S FLOW
3) PRV STATION FLOW TOTAL

C. Loop 20-3: Pressure Monitoring

1. General:

a. Provide pressure transmitter PIT-20-3-1 on the inlet side of pressure reducing valve WCV-20-1-1 to monitor system high pressure zone.

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b. Provide pressure transmitter PIT-20-3-2 on the outlet side of pressure reducing valve WCV-20-1-1 to monitor system low pressure zone.
c. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.

2. Local Control Functions:
a. Pressure transmitter PIT-20-3-1 provided under Division 26 detects pressure on the inlet side of WCV-20-1-1 and provides an analog signal PRV STATION HPZ PRESSURE to SCADA.
b. Pressure transmitter PIT-20-3-2 provided under Division 26 detects pressure on the outlet side of WCV-20-1-1 and provides an analog signal PRV STATION LPZ PRESSURE to SCADA.

3. SCADA System Control Functions:
a. Provide operator adjustable pressure set points:
1) PRV STATION LPZ LOW PRESSURE
2) PRV STATION LPZ HIGH PRESSURE
3) PRV STATION HPZ LOW PRESSURE
4) PRV STATION HPZ HIGH PRESSURE

4. SCADA System Monitoring Functions:
a. Display, trend, and record the following parameters:
1) PRV STATION LPZ PRESSURE
2) PRV STATION HPZ PRESSURE
b. SCADA System Alarming:
1) PRV STATION LPZ LOW PRESSURE
2) PRV STATION LPZ HIGH PRESSURE
3) PRV STATION HPZ LOW PRESSURE
4) PRV STATION HPZ HIGH PRESSURE
c. SCADA System Historical Data Functions:
1) Incorporate pressure monitoring and control into overall water system graphic.

D. Loop 20-4: Freeze Monitoring
1. General:
a. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.

2. Local Control Functions:
a. Temperature switch TSL-20-4-1 provided under Division 26 detects low temperature inside the PRV Station enclosure and provides discrete signal PRV STATION FREEZE to SCADA.

3. SCADA System Control Functions: None.

4. SCADA System Monitoring Functions:
a. Display, trend, and record the following parameters:
1) Monitor PRV STATION FREEZE signal.
b. SCADA System Alarming:
1) Provide PRV STATION FREEZE alarm upon activation of temperature switch.
c. SCADA System Historical Data Functions:
1) Incorporate environmental monitoring and alarm handling into overall water system graphic.

E. Loop 20-5: Control System Power and Communications Monitoring
1. General:
a. Provide for the new functions and components as identified herein.
b. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.

2. Local Control Functions:
a. The control panel mounted power fail relays provided under Division 26 shall detect CONTROL POWER FAIL condition at SCADA system local control panel 20-PLC-1 when the 120VAC control power circuit fails.

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b. The control panel mounted UPS unit at the SCADA system control panel 20-PLC-1, shall be equipped with a relay output to detect UPS FAIL condition.
c. The control panel mounted PLC shall be equipped with a heartbeat signal that if the PLC fails to execute its code a PLC ACTIVITY ALARM condition shall annunciate.
d. A PLC not located in this control panel shall communicate with this PLC on a routine basis to test the communication link. If the outside PLC cannot communicate with the 20-PLC-1 PLC, an alarm shall annunciate.

3. SCADA System Control Functions: None.
4. SCADA System Monitoring Functions:
   a. Display, trend, and record the following parameters:
      1) Provide for monitoring the control power fail and UPS fail conditions.
   b. SCADA System Alarming:
      1) 20-PLC-1 CONTROL POWER FAIL
      2) 20-PLC-1 UPS FAIL
      3) 20-PLC-1 PLC ACTIVITY ALARM
      4) 20-PLC-1 COMMUNICATION LOSS
   c. SCADA System Historical Data Functions: None.

2.05 UNIT PROCESS NO.30 – NORTH BOOSTER STATION

A. Loop 30-1: Booster Pumps
1. General:
   a. Two (2) new Booster Pumps shall pump from the low-pressure zone to the high-pressure zone.
      1) Provide Type III motor control.
   b. North Booster Station shall have provisions for one (1) future Booster Pump.
   c. Provide room for a future third Booster Pump when developing the SCADA graphics for the proposed two booster pumps at the North Booster Station. Do not configure the graphics for the future booster pump under this contract.
   d. The Contractor shall provide the instrumentation as shown on the drawings and described herein.
2. Local Control Functions:
   a. HS-30-1-1-1 on 30-PLC-1 shall change the control method of the Booster Pumps in North Booster Station between Level / Pressure / Auto.
   b. For PRESSURE CONTROL - Provide Operator Settable Pressure Setpoint for operation of North Booster Station in the event of the failures of radio communications, PLCs, or level transmitter LIT-10-2-1 failure.
      1) Provide BOOSTER PUMP ON Pressure Setpoint
      2) Provide BOOSTER PUMP OFF Pressure Setpoint
      3) Booster Pump AFD shall run at a pre-set speed on the AFD if running in PRESSURE CONTROL. This speed shall be adjustable from the drive interface unit.
      4) There is no automatic alternation in PRESSURE CONTROL.
   c. Interlock Booster Pumps with future Hypochlorite Chemical Pump to run in accordance to AFD speed feedback signals and to only run when flow meter FE-30-3-1 indicates a flow from the low pressure zone to the high pressure zone. Low to high pressure flow shall exceed an operator settable flow rate to be determined a high enough flow to run the chemical pump.
3. SCADA System Control Functions:
   a. Booster Pumps shall be interlocked with flow switch FS-30-2-1. Upon receiving signal BOOSTER STATION PRV VALVE FLOW, SCADA shall stop operation of the Booster Pumps and prevent them from being called to run until BOOSTER STATION PRV VALVE FLOW signal is clear.
   b. Booster Pumps P-30-1-1, P-30-1-2, and future P-30-1-3 shall be interlocked with the generator so that only a maximum of two (2) booster pumps can be called to run while operating on emergency generator 30-G-1.

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c. Booster Pump speed shall be controlled based upon operator settable flow setpoint. Booster Pumps shall be called to run based on operator settable tower level set point.
d. Utilize NORTH BOOSTER STATION HPZ PRESSURE in System Pressure Control Strategy.

4. SCADA System Monitoring Functions:
   a. Display, trend, and record the following parameters:
      1) Display WATER TOWER NO.3 LEVEL with Booster Pumps for Level Control.
      2) Display NORTH BOOSTER STATION HPZ PRESSURE with Booster Pumps for Pressure Control.
   b. SCADA System Alarming: None additional.
   c. SCADA System Historical Data Functions: None additional.

B. Loop 30-2: Pressure Reducing Valve Flow Monitoring
1. General:
   a. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.
2. Local Control Functions:
   a. Thermal dispersion flow switch FS-30-2-1 provides an analog signal BOOSTER STATION PRV VALVE FLOW to SCADA when the PRV valve is discharging water from the high pressure zone to the low pressure zone.
3. SCADA System Control Functions:
   a. FS-30-2-1 shall be located and configured to not provided false readings from turbulence in Booster Pump suction header.
   b. Flow switch FS-30-2-1 shall be interlocked with the Booster Pumps. Upon receiving signal BOOSTER STATION PRV VALVE FLOW, SCADA shall stop operation of the Booster Pumps and prevent them from being called to run until BOOSTER STATION PRV VALVE FLOW signal is clear.
4. SCADA System Monitoring Functions:
   a. Display, trend, and record the following parameters:
      1) BOOSTER STATION PRV VALVE FLOW
   b. SCADA System Alarming: None.
   c. SCADA System Historical Data Functions: None.

C. Loop 30-3: Flow Monitoring / Control
1. General:
   a. Bidirectional magnetic flow meter shall monitor the flow rate of low to high pressure flow and high to low pressure flow at North Booster Station. Additionally, the flow meter shall measure total flow at North Booster Station.
   b. Bidirectional magnetic flow meter FE/FIT-30-3-1 is furnished by another Division but must be wired and incorporated into the SCADA system by Division 26.
2. Local Control Functions:
   a. Flow meter/transmitter provides analog signal NORTH BOOSTER STATION FORWARD FLOW RATE (LPZ to HPZ) to SCADA.
   b. Flow meter/transmitter provides analog signal NORTH BOOSTER STATION BACKWARD FLOW RATE (HPZ to LPZ) to SCADA.
   c. Flow meter/transmitter provides pulse signal NORTH BOOSTER STATION FLOW TOTAL to SCADA.
3. SCADA System Control Functions:
   a. Provide adjustable FLOW RATE set point:
      1) FORWARD FLOW
      2) BACKWARD FLOW
   b. Utilize FORWARD FLOW signal for future Hypochlorite Chemical Pump interlock with chemical feed and dosing control.
   c. Generate NORTH BOOSTER STATION FLOW METER FAIL signal based on Booster Pumps running and no flow detected after an adjustable time delay.
   d. Provide an operator entry field to select an amount of water to pump.
4. SCADA System Monitoring Functions:
   a. Display, trend, and record the following parameters:

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1) NORTH BOOSTER STATION INSTANTENEOUS FLOW RATE
2) NORTH BOOSTER STATION FLOW DIRECTION
3) NORTH BOOSTER STATION FLOW TOTAL

b. SCADA System Alarming:
1) NORTH BOOSTER STATION FLOW METER FAIL

c. SCADA System Historical Data Functions:
1) NORTH BOOSTER STATION FLOW RATE
2) NORTH BOOSTER STATION TODAY'S FLOW
3) Non-resettable NORTH BOOSTER STATION FLOW TOTAL

D. Loop 30-4: Pressure Monitoring / Control

1. General:
a. Provide pressure transmitter PIT-30-4-1 on the suction end of the Booster Pumps piping to monitor system low pressure zone.
b. Provide pressure transmitter PIT-30-4-2 on the discharge end of the Booster Pumps piping to monitor system high pressure zone and to provide means of local backup control.
c. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.

2. Local Control Functions:
a. Pressure transmitter PIT-30-4-1 provided under Division 26 detects pressure on the suction side of the Booster Pumps and provides an analog signal NORTH BOOSTER STATION LPZ PRESSURE to SCADA.
b. Pressure transmitter PIT-30-4-2 provided under Division 26 detects pressure on the discharge side of the Booster Pumps and provides an analog signal NORTH BOOSTER STATION HPZ PRESSURE to SCADA.
c. HS-30-1-1-1 on 30-PLC-1 shall change the control method of the Booster Pumps in North Booster Station between Level / Pressure / Auto.

3. SCADA System Control Functions:
a. Provide operator adjustable pressure set points:
1) NORTH BOOSTER STATION LPZ LOW PRESSURE
2) NORTH BOOSTER STATION LPZ HIGH PRESSURE
3) NORTH BOOSTER STATION HPZ LOW PRESSURE
4) NORTH BOOSTER STATION HPZ HIGH PRESSURE

b. Utilize NORTH BOOSTER STATION HPZ PRESSURE in System Pressure Control Strategy.
1) In Auto, the method of control shall automatically switch from LEVEL CONTROL to PRESSURE CONTROL at the future North Booster Station if there is a loss of communication between the system radios or if there is a PLC failure at 10-PLC-1 (provided under a separate contract) or if the level transmitter LIT-10-2-1 (provided under a separate contract) fails.
2) Pressure Control at the future North Booster Station shall allow for a step increase in pressure if the Booster Pumps are running. This offset shall be operator settable. Provide a matrix of LEVEL setpoints for Lead Pump Required, Lag Pump Required, Lead Pump Off, and Lag Pump Off.

4. SCADA System Monitoring Functions:
a. Display, trend, and record the following parameters:
1) NORTH BOOSTER STATION LPZ PRESSURE
2) NORTH BOOSTER STATION HPZ PRESSURE

b. SCADA System Alarming:
1) NORTH BOOSTER STATION LPZ LOW PRESSURE
2) NORTH BOOSTER STATION LPZ HIGH PRESSURE
3) NORTH BOOSTER STATION HPZ LOW PRESSURE
4) NORTH BOOSTER STATION HPZ HIGH PRESSURE

c. SCADA System Historical Data Functions:
1) Incorporate pressure monitoring and control into overall water system graphic.

E. Loop 30-5: Chemical Feed

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1. General:
    a. The Hypochlorite Chemical Pump will be an addition under a future contract. Configure SCADA to accommodate for the future chemical system under this contract.
    b. The radar level transmitter will be an addition under a future contract. Configure SCADA to accommodate for the future radar level sensor under this contract.
    c. Provide the SCADA system functionality and graphics for the future chemical addition to the North Booster Station. Graphics shall be configured under this contract and put on a separate page from the rest of the North Booster Station graphics. The future chemical addition graphics shall be turned off until the future chemical addition is ready to be incorporated into SCADA.
2. Local Control Functions:
    a. Future Hypochlorite Chemical Pump shall receive REQUIRED and PACE signals from SCADA system and provide RUN, SPEED FEEDBACK, and FAIL STATUS to SCADA system.
    b. Future radar level transmitter shall provide LEVEL signal to SCADA system.
    c. Interlock the future Hypochlorite Chemical Pump to run in accordance to AFD-30-1-1 and AFD-30-1-2 speed feedback signal and to only run when flow meter FE-30-3-1 indicates a flow from the low pressure zone to the high pressure zone. Low to high pressure flow shall exceed an operator settable flow rate to be determined a high enough flow to run the chemical pump.
3. SCADA System Control Functions:
    a. The future Hypochlorite Chemical Pump shall be flow based on Booster Pump speed. The chemical pump shall provide a consistent mg/l dosage based upon an operator settable dosage set point.
4. SCADA System Monitoring Functions:
    a. Display, trend, and record the following parameters:
        1) HYPOCHLORITE CHEMICAL PUMP REQUIRED
        2) HYPOCHLORITE CHEMICAL PUMP DOSAGE
        3) HYPOCHLORITE CHEMICAL PUMP USAGE
        4) HYPOCHLORITE STORAGE TANK LEVEL
    b. SCADA System Alarming:
        1) HYPOCHLORITE CHEMICAL PUMP FAIL
        2) LOW HYPOCHLORITE USAGE
        3) HIGH HYPOCHLORITE USAGE
        4) LOW HYPOCHLRITE STORAGE TANK LEVEL
    c. SCADA System Historical Data Functions:
        1) HYPOCHLORITE DAILY TOTAL
        2) HYPOCHLORITE DAILY DOSAGE
        3) HYPOCHLORITE STORAGE TANK LEVEL

F. Loop 30-6: Intrusion
1. General:
    a. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.
2. Local Control Functions:
    a. The door switch provided under Division 26 detects if the entry door to North Booster Station is open and provides door open signal to SCADA.
    b. The SCADA system shall alarm after a pre-set time if the enable/disable button is not depressed.
3. SCADA System Control Functions:
    a. Provide intrusion monitoring per P&ID and as follows:
        1) Provide unlabeled front of panel lighted switch. The switch shall be lit when system is armed.
        2) Provide SCADA intrusion alarm on door operation after operated adjustable period.
        3) Defeat intrusion alarm for operator adjustable period and turn off light when lighted push button is pressed.
        4) Automatically re-arm system after operator adjustable period.

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4. SCADA System Monitoring Functions:
    a. Display, trend, and record the following parameters:
        1) Monitor door operation signals.
        2) Monitor NORTH BOOSTER STATION INTRUSION signal.
    b. SCADA System Alarming:
        1) Alarm on NORTH BOOSTER STATION INTRUSION. Provide an intrusion alarm if the entry door is opened and the intrusion enable / disable alarm in not disabled on a preset time. Operator shall re-enable alarm before leaving. Provide and automatic rest to enable Intrusion alarm based on Operator settable time.
    c. SCADA System Historical Data Functions:
        1) Incorporate door switch and intrusion monitoring and alarm handling into overall system graphic.

G. Loop 30-7: Building Flood and Temperature Monitoring
1. General:
    a. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.
2. Local Control Functions:
    a. Temperature transmitter provided under Division 26 detects room temperature and provides analog signal NORTH BOOSTER STATION TEMPERATURE to SCADA for North Booster Station.
    b. Flood switch in North Booster Station provides a discrete signal NORTH BOOSTER STATION FLOOD to SCADA.
3. SCADA System Control Functions: None.
4. SCADA System Monitoring Functions:
    a. Display, trend, and record the following parameters:
        1) Monitor NORTH BOOSTER STATION TEMPERATURE signal.
        2) Monitor NORTH BOOSTER STATION FLOOD signal.
    b. SCADA System Alarming:
        1) Alarm on operator adjustable HIGH and LOW NORTH BOOSTER STATION TEMPERATURE.
        2) Provide NORTH BOOSTER STATION FLOOD alarm upon activation of flood switch.
    c. SCADA System Historical Data Functions:
        1) Incorporate environmental monitoring and alarm handling into overall water system graphic.

H. Loop 30-8: Emergency Generator
1. General:
    a. Monitor North Booster Station standby power of new ATS, 30-ATS-1, and new emergency generator, 30-G-1.
    b. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.
2. Local Control Functions:
    a. Provide UTILITY AVAILABLE, LOAD CONNECTED TO UTILITY, GENERATOR AVAILABLE, and LOAD CONNTECTED TO GENERATOR discrete signals from 30-ATS-1 to SCADA.
    b. Provide GENSET EXERCISE discrete signal from 30-ATS-1 to SCADA.
    c. Provide GENERATOR RUN, GENERATOR FAIL, GENERATOR NOT IN AUTO, and GENERATOR E-STOP ENGAGED discrete signals from standby Generator Control Panel, LCP-30-8-1, to SCADA.
3. SCADA System Control Functions:
    a. Booster Pumps P-30-1-1, P-30-1-2, and future P-30-1-3 shall be interlocked with the generator so that only a maximum of two (2) booster pumps can be called to run while operating on emergency generator 30-G-1.
4. SCADA System Monitoring Functions:
    a. Display, trend, and record the following parameters:
        1) UTILITY AVAILABLE

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2) ON UTILITY
3) GENERATOR AVAILABLE
4) ON GENERATOR
5) GENSET EXERCISE
6) GENERATOR RUN
7) GENERATOR FAIL
8) GENERATOR NOT IN AUTO
9) GENERATOR E-STOP ENGAGED.

b. SCADA System Alarming:
1) UTILITY FAIL
2) ON GENERATOR
3) GENERATOR FAIL
4) GENERATOR NOT IN AUTO
5) GENERATOR E-STOP ENGAGED

c. SCADA System Historical Data Functions:
1) Graphically display standby power system and alarms.

I. Loop 30-9: Control System Power and Communications Monitoring

1. General:
a. Provide for the new functions and components as identified herein.
b. The Contractor shall provide the Instrumentation as shown on the drawings and as described herein.

2. Local Control Functions:
a. The control panel mounted power fail relays provided under Division 26 shall detect CONTROL POWER FAIL condition at SCADA system local control panel 30-PLC-1 when the 120VAC control power circuit fails.
b. The control panel mounted UPS unit at the SCADA system control panel 30-PLC-1, shall be equipped with a relay output to detect UPS FAIL condition.
c. The control panel mounted PLC shall be equipped with a heartbeat signal that if the PLC fails to execute its code a PLC ACTIVITY ALARM condition shall annunciate.
d. A PLC not located in this control panel shall communicate with this PLC on a routine basis to test the communication link. If the outside PLC cannot communicate with the 30-PLC-1 PLC, an alarm shall annunciate.

3. SCADA System Control Functions: None.

4. SCADA System Monitoring Functions:
a. Display, trend, and record the following parameters:
1) Provide for monitoring the control power fail and UPS fail conditions.

b. SCADA System Alarming:
1) 30-PLC-1 CONTROL POWER FAIL
2) 30-PLC-1 UPS FAIL
3) 30-PLC-1 PLC ACTIVITY ALARM
4) 30-PLC-1 COMMUNICATION LOSS

c. SCADA System Historical Data Functions: None.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Field verify with exact measurements, the available mounting space for control system equipment. Identify deficiencies prior to beginning installation.

B. Where ranges are indicated on the contract documents, they are to be considered preliminary. Field verify the exact ranges required based on field conditions.

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3.02 DELIVERY STORAGE AND HANDLING

A. It shall be the responsibility of the installing contractor to receive all process instrumentation and control equipment at the job site. Carefully inspect all equipment for damage prior to accepting from the shipping agency. Do not accept shipment if damage is evident.

B. Exercise due diligence in storing, protecting, and moving process instrumentation and control equipment. Damaged or worn equipment will not be accepted and will be replaced at no additional cost to the Owner.

3.03 INSTALLATION

A. Install equipment in locations as indicated on the contract documents. Adjust locations as needed to ensure operability, serviceability, and compliance with all applicable codes and standards.

B. Installation shall be completely tested prior to start-up. This work includes verification of all field wiring continuity and proper termination of wiring.

3.04 TESTING AND START-UP SERVICES

A. System Integrator shall provide installation and start-up services required to place the complete system into operation.

B. Each signal and function shall be fully tested. These tests shall be based on actual operation of primary elements and verification of proper control system response. Submit test results as part of Operations and Maintenance Manual.

C. Record calibrations of all analog devices.

D. Demonstrate proper operation of the process and instrumentation control system to the Owner and in the presence of the Engineer.

3.05 TRAINING

A. Training shall be suitable for plant operations personnel with limited knowledge of electrical components.

B. Provide two instructor days of operator training at the job site. Training shall consist of operations instruction and maintenance/trouble-shooting instruction.
   1. Operations instruction shall identify all control loops with description of all interlocks, interface with other loops, and operational input requirements. Describe procedures for re-starting the system.
   2. Maintenance instruction shall identify periodic maintenance that can be performed by the operator. Provide description of procedures and locations for replacement of consumable devices such as fuses and for checking the calibration or operation of devices.
   3. Trouble-shooting instruction shall identify simple procedures and methods for identifying potential causes in the event of failures. For example, instruct operator on correlation of input signals and PLC I/O module indicator lights.

PART 4 MEASUREMENT AND PAYMENT

4.01 PROCESS INSTRUMENTATION & CONTROL

A. Process Instrumentation & Control shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Process Instrumentation & Control, Lump Sum. When so provided, payment for Process Instrumentation & Control shall be included with payment for Process Instrumentation & Control

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and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.

2. Process Instrumentation & Control, Inclusive. When no quantity is provided, Process Instrumentation & Control shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 10
CONTROL PANEL CONSTRUCTION

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards:
      a. ANSI/NFPA 70 - National Electrical Code and state amendments thereto.
      b. ANSI/NFPA 79 - Electrical Standard for Industrial Machinery.
   2. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition.
   3. Canadian Standards Associates (CSA), Specifications and Standards, Current Edition.
      a. CSA Standard C22.2 No. 0 - General Requirements - Canadian Electrical Code, Part II
      b. CSA Standard C22.2 No. 0.4 - Bonding and Grounding of Electrical Equipment (Protective Equipment)
      c. CSA Standard C22.2 No. 14 - Industrial Control Equipment for Use in Ordinary (Non-Hazardous) Locations
      d. CSA Standard C22.2 No. 40 - Cutout, Junction, and Pull boxes
      e. CSA Standard C22.2 No. 94 - Special Purpose Enclosures
   4. Electrical and Electronic Manufacturers Association Canada (EEMAC), Specifications and Standards, Current Edition.
   5. International Electrotechnical Association (IEC), Specifications and Standards, Current Edition.
      a. IEC 60529 - Classification of Degrees of Protection Provided by Enclosures
      b. IEC 60204 - Safety of Machinery - Electrical Equipment of Machines
      c. IEC 60079 - Electrical Apparatus for Explosive Gas Atmospheres
   6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition.
      a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
      b. NEMA ICS6 - Enclosures for Industrial Controls and Systems
   7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.
      a. UL50 - Cabinets and Boxes
      b. UL508 - Industrial Control Equipment
      c. UL508A - Industrial Control Panels
      d. UL 698A - Industrial Control Panels - with Intrinsically Safe Circuits entering Hazardous Areas.
      e. UL94 - Flammability of Plastic Materials

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

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B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. All control panels shall be constructed in accordance with UL 508 standards and shall bear the UL 508 listing.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Provide one spare vapor phase corrosion inhibiting capsule for each control panel.

C. Provide a ten or twenty percent of the total number of terminals as installed spares in each control panel.

1.10 DESIGN REQUIREMENTS

CONTROL PANEL CONSTRUCTION REQUIREMENTS

TAG NUMBER	DESCRIPTION	TYPE	SIZE	UPS	NOTES
20-PLC-1	PRV STATION PLC CONTROL PANEL	A	42"W x 36"H x 15"D	X	1
30-PLC-1	NORTH BOOSTER STATION PLC CONTROL PANEL	A	42"W x 42"H x 15"D	X	1,2

NOTES:

1. 120VAC UPS required
2. Wall space limitations in structure. Width of panel shall not exceed the width listed in this table.

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PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Fabricate, install instruments, plumb and wire in factory.

B. Test wiring and plumbing prior to shipment.

C. Make external connections by way of numbered terminal blocks.

D. Separate electrical components from pneumatic and hydraulic components by metal barriers.

E. Conform to ISA standards.

2.02 TYPE A - CONTROL PANEL ENCLOSURE, WALL-MOUNTED

A. Manufacturer:
1. Hoffman Enclosures, Inc. Concept Wall-Mount Enclosure
2. or equal

B. Environmental Rating:
1. NEMA Type 4/12

C. Construction:
1. 16 gauge or 14 gauge steel
2. Seams continuously welded and ground smooth
3. Minimum width body flange trough excludes liquids and contaminants
4. Integral body grounding stud
5. Panel mounting studs
6. Mounting holes in back of body for direct mounting
7. Hidden hinges for clean aesthetic appearance
8. Standard full access 170 degree door opening
9. Doors are interchangeable and easily removable by pulling captive hinge pins
10. Door bar on hinge side for wire management and grounding
11. Additional door bar and stiffener on larger enclosures for extra rigidity
12. High-impact thermoplastic data pocket
13. Seamless foam-in-place one-piece gasket provides oil-tight and dust-tight seal against contaminants
14. Self-grounding latch system with double seal provides maximum protection against leakage
15. Quarter-turn door latching system installed on door with a slotted insert
16. Internal, switch operated fluorescent light
17. Finish:
    a. Gray or textured light gray polyester powder coated inside and out
    b. Steel sub-panels are painted white

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

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3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.04 CONTROL PANEL FABRICATION AND ENVIRONMENTAL PROTECTION REQUIREMENTS

A. Instrument Mounting:
   1. Locate instruments designated for back-of-panel mounting in manner to allow for maintenance and adjustment.
   2. Instrument mounting height shall not exceed 6 ft-6 in. Minimum height shall be 4 ft-0 in.
   3. Panel cutouts for instruments and other devices, such as lights and switches, shall be cut, punched, or drilled and smoothly finished with rounded edges.
   4. Provide steel angle stiffeners on back of panel face to prevent panel deflection under instrument loading or operation.
   5. Provide internal structural steel framework for instrument support purposes and panel bracing. Internal framework shall permit lifting of panel without racking or distortion.

B. Equipment Mounting:
   1. Provide shelf or bracket support for any equipment not secured to panel, such as a UPS, router, firewall, or Wi-Fi access point. Shelf placement shall allow for bending space for wiring entering panel.

C. Corrosion Protection:
   1. Provide vapor phase corrosion inhibiting capsules in each control panel to protect all exposed metal surfaces for a period of at least two years. Corrosion inhibiting modules shall be Northern Instrument Corporation, Zerust vapor capsules Model VC-2-2 or Hoffman Engineering Corporation corrosion inhibitor Model A-HCI-5.
   2. Provide thermostatically controlled condensation heater in panels located high humidity areas and in areas in which ambient temperature will vary. Heater shall be sized to prevent condensation within panel.

D. Heating, Ventilating, and Air Conditioning:
   1. Provide heating equipment as specified under Part 2.
   2. Provide filtered ventilation fan(s) where needed and sized to dissipate heat generated by components located within control panel.
   3. Provide filtered air conditioning equipment and insulate panel where needed to maintain internal panel temperature within operating parameters of internal panel components.

3.05 CONTROL PANEL ELECTRICAL REQUIREMENTS

A. Electric Service:
   1. Design control panel to operate on electrical supply indicated on the drawings.
      a. Three phase service:
         1) Provide main circuit breaker.
         2) Provide branch circuit breakers for distribution of three phase and single phase power at voltages above 120VAC.
         3) Control panel and internal components shall be rated to interrupt the available fault current.
         4) Main circuit breaker and branch circuit breakers shall be coordinated such that a fault in a branch circuit will trip only the branch circuit breaker and not the main circuit breaker.
         5) Separate 480VAC wiring from control voltage wiring.
         6) Provide appropriately sized control power transformer.
         7) Provide miniature circuit breakers for distribution of 120VAC control power in accordance with the following:
            (a) No more than 20 devices on any single circuit.

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(b) Where multiple units perform parallel operations, do not group all devices on the same branch circuit. The purpose is to prevent the failure of any single branch circuit from shutting down at entire operation.
(c) Do not exceed the ampacity of the branch circuit.
(d) Panel service outlet shall be protected by separate branch circuit breakers
(e) Power supplies shall be protected by separate branch circuit breakers.

8) Provide 20 amp, 120VAC service outlet circuit within back-of-panel area.
9) Control power transformer fuses and branch circuit breakers shall be coordinated such that a fault in a branch circuit will trip only the branch circuit breaker and not the control power transformer fuses.
10) Branch circuit breakers shall be rated for 15A and 250VAC.
11) Fuses shall not be substituted for circuit breakers.

b. Single phase service:
1) Provide 20A main circuit breaker.
2) Provide miniature circuit breakers for distribution of 120VAC control power in accordance with the following:
(a) No more than 20 devices on any single circuit.
(b) Where multiple units perform parallel operations, do not group all devices on the same branch circuit. The purpose is to prevent the failure of any single branch circuit from shutting down at entire operation.
(c) Do not exceed the ampacity of the branch circuit.
(d) Panel service outlet shall be protected by separate branch circuit breakers
(e) Power supplies shall be protected by separate branch circuit breakers.
3) Provide 20A, 120VAC service outlet circuit within back-of-panel area - protected by a 15A breaker.
4) Main circuit breaker and branch circuit breakers shall be coordinated such that a fault in a branch circuit will trip only the branch circuit breaker and not the main circuit breaker.
5) Branch circuit breakers shall be rated for 15A and 250VAC.
6) Fuses shall not be substituted for circuit breakers.

c. Uninterruptible power supply:
1) Where panel is equipped with an uninterruptible power supply, provide distribution of 120VAC power on the line and load sides of the UPS.
2) Panel service outlet and other non-critical loads shall be powered from the line side of the UPS. Critical loads, including but not limited to all digital control equipment, shall be powered from the load side of the UPS.
3) Provide UPS bypass circuitry for 24VDC UPS systems or for systems that do not have a double conversion type UPS installed.

d. Back-up control systems:
1) Where panel includes fail-safe back-up control circuitry, the back-up control circuits shall be fed with a separate circuit from a lighting panel or from a separate control power transformer.

B. Output Signal Fusing:
1. Provide appropriately sized fuses for all output signals to devices located external to the panel in accordance with the following requirements:
a. Maximum fuse size: 5A
b. Separate fuse for each device
c. Fuses shall be installed in indicating type fuse holder terminal blocks.

C. Control Panel Wiring:
1. Wiring within panels, consoles, racks, and cabinets shall meet the following requirements:
a. Wires for ac circuits shall be 300V or 600V, Type MTW stranded copper and shall be sized for the current to be carried but not smaller than No.16 AWG.

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b. Wires for analog signal circuits shall be 300V stranded copper and shall be twisted shielded pairs not smaller than No.18 AWG.
c. Wires for other dc circuits shall be 300V, Type MTW stranded copper not smaller than No.18 AWG.
d. Wiring for special signals such as communications, digital data, and multiplexed signals shall use manufacturers standard cables.

2. Terminal blocks for panels, consoles, racks, and cabinets shall meet the following requirements:
a. Wire all spare or unused panel mounted elements, including PLC input/output points, to terminal blocks.
b. Provide open construction terminal blocks for wiring that is entirely internal to the panel.
c. Provide isolation switch terminal blocks for all wiring that is not entirely internal to the panel.
d. Rail-mount individual terminals to create a complete assembly. Provide terminals constructed such that jumpers can be installed with no loss of space on terminal or rail.
e. Size all terminal block components to allow insertion of all necessary wire sizes and types.
f. Provide power distribution blocks for distribution of control panel power at voltages exceeding 120VAC.

3. Grounding:
a. Panels, consoles, racks, and cabinets shall be provided with an isolated copper grounding bus for all signal and shield ground connections. This ground bus shall be grounded at a common single ground point. The signal grounding system shall meet National Electrical Code requirements.
b. Each analog loop shall only be grounded at a single point for the loop. This single point shall be at the location of the dc power supply for the loop.

D. Power Supplies:
1. Provide dc power supplies as required to power instruments requiring external dc power, including two-wire transmitters and dc relays.
2. Power supplies shall be suitable for intrinsically safe circuits where two-wire transmitters are located in a hazardous area.

E. Electrical Transient Protection:
1. All electrical and electronic elements of the control system shall be protected against damage due to electrical transients induced in interconnecting lines from lighting discharges and nearby electrical systems.
2. Surge Suppressor Locations:
a. As a minimum, provide surge suppressors at the following locations:
1) Provide 480VAC, panel mounted surge suppressor on the load side of each 480VAC main circuit breaker in each panel.
2) Provide 120VAC, panel mounted surge suppressor on the load side of each 120VAC main circuit breaker in each panel.
3) Provide 24VDC, panel mounted surge suppressor at the panel connections of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.
4) Provide 24VDC, field mounted surge suppressor at the field connection of each analog signal transmitter located outside of a protecting building.

3.06 STANDARD SIGNAL INTERFACES

A. Unless otherwise specified discrete input and output signals shall conform to the following:
1. Isolated unpowered (dry) contact closures.
2. Power contact from panel receiving signal or device receiving signal.

B. Unless otherwise specified input and output analog signals shall conform to following:
1. External to panel: isolated, 4-20 mADC.
2. Internal to panel: 1 to 5VDC signals.

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3. For 2-wire transmitter provide isolated type and power with 24VDC from panel or device receiving signal.
4. Where isolation is required to interface with particular equipment or because of loop impedance, provide isolated, DC-to-DC transmitter.

3.07 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.08 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 CONTROL PANEL CONSTRUCTION

A. Control Panel Construction shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
1. Control Panel Construction, Lump Sum. When so provided, payment for Control Panel Construction shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Control Panel Construction, Inclusive. When no quantity is provided, Control Panel Construction shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 11
CONTROL PANEL COMPONENTS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. ANSI/NFPA 70 - National Electrical Code and state amendments thereto.
      b. ANSI/IEEE C37.90 - IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus.
      c. ANSI/IEEE C62.11- IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits.
      d. ANSI/IEEE C62.34 - IEEE Standard for Performance of Low-Voltage Surge-Protective Devices (Secondary Arresters).
      e. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   2. CE - European Community, Applicable Directives.
      a. EN50005 - for Terminal Markings.
      b. EN50081-1- Generic Emission Standard.
      c. EN50082-1 - Generic Immunity Standard.
      d. EN61000-4-4 - Electromagnetic compatibility (EMC). Testing and measurement techniques.
      e. EN61000-4-5 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
   3. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, Industrial Control Equipment.
   4. CUL - Underwriter's Laboratories of Canada.
   5. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC 60529 - Classification of Degrees of Protection Provided by Enclosures
   6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
      b. NEMA ICS 3 - Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC.
   7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL508 - Industrial Control Equipment.
      b. UL508A - Industrial Control Panels.
      c. UL 913 - Intrinsically Safe Specification.
      d. UL94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control

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1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Supply two spare lamps of each type supplied for this project.

C. Supply two spare relays of each type supplied for this project.

PART 2 PRODUCTS

2.01 CIRCUIT BREAKER - MINIATURE

A. Manufacturer:
   1. Square D QOU Unit Mount Class 720
   2. Or equal

B. Agency Approvals:
   1. UL Listed

C. General:

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1. Surface, flush or DIN rail mounting in one-, two- and three-pole construction.
2. Used for overcurrent protection and switching on both ac and dc systems.

D. Construction:
1. Terminal lug wire size: 1- No.14 - No.2 AWG Cu or Al
2. Reversible line and load lugs for convenient flush or surface mount wiring
3. DIN mounted (symmetrical rail 35 x 7.5 DIN/EN 50 022)
4. UL Listed as HACR type -- 15A to 70A
5. Field installable quick connectors
6. Single handle with internal common trip
7. UL Listed 48VDC (5,000 AIR)

2.02 CONTROL POWER TRANSFORMER

A. Manufacturer:
1. Cutler Hammer, Type MTE
2. Square D
3. Or equal

B. Agency Approvals:
1. UL Listed
2. CSA Certified

C. Construction:
1. Epoxy encapsulated coils
2. High quality silicon steel laminations
3. Copper magnet wire
4. 55 degree C rise, Class 105 insulation system
5. Molded terminals

D. Electrical:
1. Capacity:
   a. Select transformer VA rating based upon connected load with an additional 25 percent spare capacity.
2. Primary terminals:
   a. 240 x 480VAC
   b. 230 x 460VAC
   c. 220 x 440VAC
   d. Finger-safe terminal covers
3. Secondary terminals:
   a. 120VAC
   b. 115VAC
   c. 110VAC
   d. Finger-safe terminal covers
4. Fusing:
   a. Dual primary fuse block
   b. Single secondary fuse block
   c. Finger-safe fuse block covers
   d. Class CC fuses, sized for VA rating of transformer
5. Mounting:
   a. Back panel

2.03 PILOT DEVICE - INDICATING LIGHT

A. Manufacturer:
1. Allen Bradley Bulletin 800T/800H
2. Or equal

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B. Agency Approvals:
   1. UL Listed
   2. CSA Certified
   3. CE Compliant

C. Mechanical:
   1. Size: 30.5 mm
   2. Environmental rating:
      a. NEMA 4/13 watertight/oiltight: NEMA 1, 12, 3R, 4 control panels
      b. NEMA 4/4X corrosion resistant: NEMA 4X control panels and remote control stations
   3. Life expectancy: 200,000 operations
   4. Push-to-test, transformer type, dual input

D. Electrical:
   1. Input power: 120VAC
   2. Lamp:
      a. High visibility, 28 chip cluster LED
      b. Color: red, green, amber, as scheduled
   3. Lens: High impact plastic, colored to match lamp

E. Nameplate: Standard or jumbo with engraved service legend

F. Field Mounted Control Stations:
   1. Type I Enclosure: NEMA 4X polycarbonate enclosure
   2. Type II Enclosure: NEMA 4X stainless steel enclosure
   3. Type III Enclosure: NEMA 7 hazardous location enclosure

2.04 PILOT DEVICE - PUSHBUTTON

A. Manufacturer:
   1. Allen Bradley Bulletin 800T/800H
   2. Or equal

B. Agency Approvals:
   1. UL Listed
   2. CSA Certified
   3. CE Compliant

C. Mechanical:
   1. Size: 30.5 mm
   2. Environmental rating:
      a. NEMA 4/13 watertight/oiltight: NEMA 1, 12, 3R, 4 control panels
      b. NEMA 4/4X corrosion resistant: NEMA 4X control panels and remote control stations
   3. Life expectancy: 10,000,000 operations
   4. Momentary contact, non-illuminated

D. Electrical:
   1. Rated Voltage: 120VAC
   2. Continuous current rating:
      a. AC: 10A
      b. DC: 2.5A
   3. Operational current:
      a. Make: 7200VA
      b. Break: 720VA
   4. Operator:
      a. Mushroom head: Emergency stop service
      b. Flush-head: All other services

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E. Nameplate: Standard or jumbo with engraved service legend

F. Field Mounted Control Stations:
1. Type I Enclosure: NEMA 4X polycarbonate enclosure
2. Type II Enclosure: NEMA 4X stainless steel enclosure
3. Type III Enclosure: NEMA 7 hazardous location enclosure

2.05 PILOT DEVICE - SELECTOR SWITCH

A. Manufacturer:
1. Allen Bradley Bulletin 800T/800H
2. Or equal

B. Agency Approvals:
1. UL Listed
2. CSA Certified
3. CE Compliant

C. Mechanical:
1. Size: 30.5 mm
2. Environmental rating:
a. NEMA 4/13 watertight/oiltight: NEMA 1, 12, 3R, 4 control panels
b. NEMA 4/4X corrosion resistant: NEMA 4X control panels and remote control stations
3. Life expectancy: 1,000,000 operations
4. Maintained contact, non-illuminated (spring return from right or left where scheduled)

D. Electrical:
1. Rated Voltage: 120VAC
2. Continuous current rating:
a. AC: 10A
b. DC: 2.5A
3. Operational current:
a. Make: 7200VA
b. Break: 720VA
4. Operator:
a. Standard knob operator, two-position, or three-position
b. Keyed operator: where scheduled

E. Nameplate: Standard or jumbo with engraved service legend

F. Field Mounted Control Stations:
1. Type I Enclosure: NEMA 4X polycarbonate enclosure
2. Type II Enclosure: NEMA 4X stainless steel enclosure
3. Type III Enclosure: NEMA 7 hazardous location enclosure

2.06 POWER SUPPLY - 12/24VDC

A. Manufacturer:
1. Phoenix Contact Quint Series
2. SOLA/Hevi-Duty Series SDP
3. IDEC
4. Or equal

B. Agency Approvals:
1. UL Listed
2. CSA Approved

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C. Mechanical:
1. Enclosure:
a. IP20
b. Sealed plastic
c. Fine ventilation grid
2. Mounting: DIN rail

D. Electrical:
1. Capacity:
a. Size to power connected loads. Reserve 25 percent of capacity for future use.
b. Provide multiple power supplies where needed to accommodate load.
2. Input:
a. Voltage: 100-240VAC
b. Frequency: 45-65Hz
c. Efficiency: 88.5 percent
d. Current: 1.0A at 100VAC
3. Output:
a. Voltage: 24VDC +/- 1% or 10-12VDC
b. Voltage regulation: 1 percent
c. Overvoltage protection: <32 VDC
d. Noise suppression: EMI values below EN50081-1
e. Current: 120W at 24VDC or 2.5A at 12VDC
4. Redundancy Module
a. For MCC applications provide active redundance module
b. Auto Current Balancing
c. Evenly distributes load balance between power supplies.
d. Over Voltage Protection
5. Monitoring:
a. LED Indicator
b. Output power good status contact

2.07 POWER SUPPLY - 120VAC, UNINTERRUPTIBLE

A. Manufacturer:
1. Allen Bradley 1609 -P
2. Eaton/Powerware 9SX
3. Or equal

B. Agency Approvals:
1. UL Listed
2. CE Marked
3. FCC Approved

C. General:
1. Topology: True online, double-conversion
2. Diagnostics: Full system self-test on power up
3. UPS Bypass Automatic: on Overload or UPS failure less than 4 ms
4. Transfer Time to battery: 0 ms
5. Overload Capacity:
a. 125 percent for 10 minutes before transfer to bypass
b. 150 percent for 10 seconds before transfer to bypass

D. Input:
1. Input voltage: 80-144VAC, single phase, 60 Hz
2. Input power factor: greater than 95 percent
3. Input Line: NEMA 5-15 plug and cord
4. Protection: fuse or circuit breaker

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E. Electrical Output:
1. Voltage Regulation:
a. On Utility: +/-2 percent of nominal
b. On Battery: +/-3 percent of nominal
2. Nominal Output Voltage: Same as selected input voltage
3. Output Voltage Waveform: Sine Wave
4. Output Voltage Distortion: less than 3 percent THD
5. Output Line: 4 NEMA 5-15 receptacles, minimum
6. Output protection: Electronic overload sensing, and circuit breaker protection
7. Efficiency:
a. Online Mode: greater than 86 percent
b. Hi-Efficiency Mode: greater than 90 percent

F. Battery:
1. Internal Battery type: Sealed, lead-acid; maintenance free
2. On Battery Runtime: ten minutes
3. Battery Replacement: Hot-swappable internal batteries
4. Recharge Time: less than 4 hours to 90 percent capacity
5. Start-On-Battery: Allows start of UPS without utility input

G. Environmental:
1. Temperature:
a. Operating: 32 to 104 degrees F
b. Storage: 5 to degrees 122 F
2. Relative Humidity: 0 to 95 percent non-condensing
3. Audible Noise at 1 meter: less than 52dB
4. Altitude: 10,000 feet without deteriorating

H. Communications:
1. Relay Output:
a. Common Alarm
b. Low Battery
c. UPS Fault
2. User Interface: LCD status screen
3. Audible Alarms UPS alarm conditions, including:
a. On-Battery
b. Low Battery
c. Overload
d. UPS Fault
4. Communications: One RS232 Serial Port; One Communications Slot; One USB Port
5. Communications cable: 6-foot communications cable included
6. Power Management Software: Powerware Software Suite CD

I. Manufacturers Warranty:
1. Warranty: 2 year comprehensive, including battery
2. Equipment Protection Policy: $25,000 lifetime protection including lightning damage

2.08 RELAY - 120V GENERAL PURPOSE

A. Manufacturer:
1. Allen Bradley Bulletin 700-HB
2. Or equal

B. Agency Approvals:
1. UL Listed
2. CE Marked

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C. Mechanical:
1. Enclosure: Transparent dust cover
2. Contacts: Silver cadmium oxide
3. Insulating Material: Molded, high dielectric
4. Terminal Markings: In accordance with EN50-0005
5. Life expectancy: 10,000,000 operations
6. Operations:
a. Pickup: 20 mS
b. Dropout: 4 mS
c. Maximum Rate: Four operations per second
7. Blade style, quick connect terminals

D. Electrical:
1. Contacts:
a. Double-pole, double throw
b. Rated thermal current: 15A
c. Make: 60A
d. Break: 6A
2. Coil:
a. 120 VAC + 10, -20 percent
b. Consumption.
1) Inrush: 2.85 VA
2) Sealed: 1.9 VA
3. Voltage:
a. Rated Insulation Voltage: 250V IEC-300V UL/CSA
b. Dielectric Withstand Voltage:
1) Pole-to-Pole: 1500V
2) Contact to Coil: 6000V
3) Contact to Frame: 4000V
4. Push-to-Test Operator
5. Pilot light

E. Relay Socket:
1. 11-blade
2. Finger-safe terminal
3. DIN rail mounted
4. Double tier
5. Retainer clip
6. Relay identification snap-in markers

2.09 RELAY - SOLID STATE

A. Manufacturer:
1. Allen Bradley Bulletin 700-SH
2. Or equal

B. Agency Approvals:
1. UL Recognized
2. CE Marked

C. Electrical:
1. Input:
a. Voltage: 4-32VDC
b. Impedance: 15mA, maximum, voltage dependent
c. Pick-up voltage: 4VDC
d. Drop-out Voltage: 1VDC
e. Dielectric Strength: 2500VACrms

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f. Reverse voltage protection

2. Output:
   a. Continuous current: 10A
   b. Voltage range: 19-264VAC
   c. Contact: SPST - N.O.
   d. Off State leakage: 5 mA max (at 100VAC)
   e. Turn-On/Turn-Off time; 0.5 cycle
3. Features:
   a. Photo isolation
   b. Dual SCR output
   c. Built-in snubber

2.10 RELAY - TIME DELAY

A. Manufacturer:
   1. Allen Bradley Bulletin 700-HS
   2. Or equal

B. Agency Approvals:
   1. UL Listed
   2. CE Marked

C. Mechanical:
   1. Insulation resistance: 100 Mohms, minimum
   2. Dielectric strength: 1500VAC, 1 minute
   3. Vibration resistance: 6N
   4. Shock resistance: 500N
   5. Operating temperature: -20 to 65 degrees C
   6. Operating humidity: 45 to 85 percent, relative
   7. Blade style: quick-connect terminals

D. Electrical:
   1. Contacts:
      a. Two Form C double-pole, double-throw
      b. 10A, 240VAC, resistive
   2. Timing functions:
      a. Delay on make/interval
      b. Delay on break/single shot
      c. Range: 0.1 seconds - 10 minutes, or 0.1 minutes - 10 hours
   3. Accuracy:
      a. Repeat: + 0.25 percent
      b. Voltage: + 1.0 percent
      c. Temperature error: + 2.0 percent
      d. Setting error: + 10.0 percent

E. Relay Socket:
   1. 11-blade
   2. Finger-safe terminal
   3. DIN rail mounted
   4. Double tier
   5. Retainer clip
   6. Relay identification snap-in markers

2.11 SURGE SUPPRESSOR - 24VDC/120VAC SIGNAL, PANEL MOUNTED

A. Manufacturer:
   1. Circuit Components Incorporated, Surge Control SPU Series.

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a. Base Module: SPU-xx-LM.
b. Daughter Module: SPU-xx-CD-30/120.

2. Or equal.

B. Agency Approvals:
1. UL Listed.

C. General Description:
1. Performance exceeds highest class severity level of IEC/EN 61000-4-4 and 61000-4-5.
2. Enhanced filtering to attenuate high frequency and bring equipment into compliance with IEEE /ANSI C37.90.1.
3. Universal hardwired version for all I/O modules including AC, DC, contact output, current output and signal input.
4. Multi-stage design provides the most effective suppression and filtering available, and requires no additional secondary protection.
5. Sub-nano second response time stops failures due to lightning, spikes and over-voltage surges while filtering all other electrical noise.
6. Plug-in replaceable daughter card modules contain all active surge suppression.
7. Space efficient protector is hermetically sealed and suitable for the most harsh industrial environments.
8. Universal DIN-Rail mounting allows easy installation on any standard DIN-Rail configuration.
9. Automatic reset and fail safe design requires no maintenance. Eliminates “Out of Service” downtime and repair/replacement costs caused by damaging electrical surges.
10. Protection for current loop instrumentation and low frequency signal/data lines.
11. UL-497B listed for Data Models (60 VDC or less) UL file E205158.

2.12 SURGE SUPPRESSOR - 120VAC/208VAC/480VAC POWER, PANEL MOUNTED

A. Manufacturer:
1. Phoenix Contact Plugtrab SEC Type 3
2. Or equal

B. Agency Approvals:
1. UL Listed

C. General Descirption:
1. ANSI/IEEE C62.11 for Category 'C' locations. The arrester shall provide protection between each phase conductor and ground. The Secondary Surge Arrester shall employ parallel MOV's and provide protection from Category 'C' level transient surges as defined in ANSI/IEEE C62.11, C62.34, C62.41.1 and C62.41.2 without degradation of components.
2. The Maximum Continuous Operating Voltage (MCOV) shall be comply with the following:
a. 120VAC, single phase system: 150VAC
b. 120/240VAC, single phase system: 150VAC
c. 120/208VAC, three phase system: 150VAC
d. 240VAC, three phase system: 275VAC
e. 480VAC, three phase system: 550VAC
3. The arrester housing shall be constructed of UV resistant polycarbonate or material of equal strength and UV resistance. All electrical connections shall be sealed in a UL component recognized epoxy to exclude moisture, dirt and corrosion. The encapsulation shall have a minimum UL Flame Class rating of 94V-0. A one-half inch threaded nipple and locknut shall be provided. Leads shall be a minimum of twelve gauge and eighteen inches in length.
4. When subjected to a 8 x 20 micro-second test impulse, the Peak Clamping Voltage shall comply with the following: be no greater than 480V for 1500A, 710V for 5,000A or 1,110V for 10,000A (4 x 10 micro-second).
a. 120VAC, or 120/240VAC, single phase systems:
1) 480VAC for 1500A (4 x 10 micro-second)
2) 710V for 5,000A (4 x 10 micro-second)

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3) 1,110V for 10,000A (4 x 10 micro-second)
b. 120/208VAC, 240VAC, or 277/480VAC, three phase systems:
1) 1850VAC for 1500A (4 x 10 micro-second)
2) 2320V for 5,000A (4 x 10 micro-second)
3) 2660V for 10,000A (4 x 10 micro-second)

D. Electrical:
1. Technology: Parallel Metal Oxide Varistors (40 kA Line to Ground)
2. Configuration: Each line to ground/neutral
3. Enclosure: Weatherproof and UV resistant NEMA 4 molded polycarbonate with metal threaded nipple
4. Operational indicators: Monitoring circuits supervise components in each phase. Individual green LED for each phase indicates proper operation. LED's will turn OFF on failure of protection
5. Encapsulation: UL component recognized epoxy potting compound. UL Flame class 94V-0; Relative Temperature Index: Electric - 90, Mechanical - 90
6. Mounting: 1/2-inch x 20 threaded nipple
7. Mounting bracket: Right angle aluminum bracket
8. Wiring: 18-inch of 12 gauge stranded copper wire is pre-connected for each phase, neutral and ground
9. Wire color code: Black - phase leads, White - ground/neutral lead
10. Ambient operating temperature: -40 to 185 degrees F

E. Manufacturer's Warranty:
1. 10 year limited

2.13 TERMINAL BLOCK - INDICATING FUSED

A. Manufacturer:
1. Allen Bradley Bulletin 1492-H4 (AC) or 1492-H5 (DC)
2. Or equal

B. Agency Approvals:
1. UL
2. CSA
3. IEC

C. Specifications:
1. Voltage Rating: 300VAC/VDC
2. Maximum Current: 12A
3. Wire Range (Rated Cross Section): No.30 to no.12 AWG
4. Leakage Current:
a. 2 mA at 300VAC
b. 2 mA at 24VDC
5. Working Voltage:
a. 100 to 300VAC
b. 10 to 57VAC/VDC
6. Fuse Size: 1/4 in x 1-1/4 in
7. Wire Strip Length 0.38 in
8. Tightening Torque: 3 to 7 lb-in
9. Density: 33 pcs./ft
10. Insulation Temperature Range: -40 to 221 degrees F
11. Accessories:
a. Aluminum DIN Rail with Standoff Brackets
b. End Barrier and End Anchors
c. Side Jumper Insulating Sleeve
d. Marking Systems

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2.14 TERMINAL BLOCK - ISOLATING SWITCH

A. Manufacturer:
   1. Allen Bradley Bulletin 1492-H7
   2. Or equal

B. Agency Approvals:
   1. UL
   2. CSA
   3. IEC

C. Specifications:
   1. Voltage Rating: 300VAC/VDC
   2. Maximum Current: 15A
   3. Wire Range (Rated Cross Section): No.30 to No.12 AWG
   4. Leakage Current:
      a. 2 mA at 300VAC
      b. 2 mA at 24VDC
   5. Working Voltage:
      a. 100 to 300VAC
      b. 10 to 57VAC/VDC
   6. Dummy Fuse Size: 1/4 in x 1-1/4 in
   7. Wire Strip Length 0.38 in
   8. Tightening Torque: 3 to 7 lb-in
   9. Density: 33 pcs./ft
   10. Insulation Temperature Range: -40 to 221 degrees F
   11. Accessories:
      a. Aluminum DIN Rail with Standoff Brackets
      b. End Barrier and End Anchors
      c. Side Jumper Insulating Sleeve
      d. Marking Systems

2.15 TERMINAL BLOCK - OPEN STYLE

A. Manufacturer:
   1. Allen Bradley Bulletin 1492-CAM1
   2. Or equal

B. Agency Approvals:
   1. UL
   2. CSA
   3. IEC

C. Specifications:
   1. Voltage Rating: 600VAC/VDC
   2. Maximum Current: 65A
   3. Wire Range (Rated Cross Section): No.22 to No.8 AWG
   4. Wire Strip Length 0.38 in
   5. Tightening Torque: 10 to 16 lb-in
   6. Density: 30 pcs./ft
   7. Insulation Temperature Range: -40 to 221 degrees F
   8. Accessories:
      a. Aluminum DIN Rail with Standoff Brackets
      b. End Barrier and End Anchors
      c. Side Jumper Insulating Sleeve
      d. Marking Systems

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2.16 TRANSMITTER - ISOLATED DC TO DC

A. Manufacturer:
   1. Wilkerson Instrument Co., Model MM4300A
   2. Or equal

B. Agency Approvals:
   1. UL Listed

C. Construction:
   1. 8-pin, relay socket
   2. Operating temperature: -10 to 60 degrees C

D. Electrical:
   1. Input: 4-20 mADC or 0-10VDC
   2. Input impedance:
      a. Voltage: 200 kOhms
      b. Current 50 Ohms
   3. Output range:
      a. Voltage: 0 - 10 VDC, 2 kOhm minimum load
      b. Current: 4-20 mADC, 24VDC compliance (1200 ohms/20 mADC)
   4. Response time: Less than 100 ms
   5. Accuracy: + 0.1 percent of span
   6. Linearity: + 0.05 percent of span
   7. Common mode rejection: 120 dB
   8. Isolation:
      a. 500 megohms
      b. 1000VAC

E. Manufacturer's Warranty:
   1. 10 year limited

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

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PART 4 MEASUREMENT AND PAYMENT

4.01 CONTROL PANEL COMPONENTS

A. Control Panel Components shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

1. Control Panel Components, Lump Sum. When so provided, payment for Control Panel Components shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Conditions - Division 1.
2. Control Panel Components, Inclusive. When no quantity is provided, Control Panel Components shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 20
INSTRUMENTATION DEVICES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. ANSI/NFPA 70 - National Electrical Code and state amendments thereto.
      b. ANSI/IEEE C37.90 - IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus.
      c. ANSI/IEEE C62.11- IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits.
      d. ANSI/IEEE C62.34 - IEEE Standard for Performance of Low-Voltage Surge-Protective Devices (Secondary Arresters).
      e. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   2. CE - European Community, Applicable Directives.
      a. EN50005 - for Terminal Markings.
      b. EN50081-1- Generic Emission Standard.
      c. EN50082-1 - Generic Immunity Standard.
      d. EN61000-4-4 - Electromagnetic compatibility (EMC). Testing and measurement techniques.
      e. EN61000-4-5 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
   3. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, Industrial Control Equipment.
   4. CUL - Underwriter's Laboratories of Canada.
   5. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC 60529 - Classification of Degrees of Protection Provided by Enclosures
   6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
      b. NEMA ICS 3 - Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC.
   7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL508 - Industrial Control Equipment.
      b. UL508A - Industrial Control Panels.
      c. UL 913 - Intrinsically Safe Specification.
      d. UL94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control

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1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

1.10 DESIGN REQUIRMENTS

TYPE	TAG NUMBER	INSTRUMENT DESCRIPTION
F10	FS-30-2-1	NORTH BOOSTER STATION PRESSURE REDUCING VALVE FLOW SWITCH
L7	LSH-30-7-1	NORTH BOOSTER STATION ROOM FLOOD SWITCH
P4	PIT-20-3-1	PRV STATION HPZ PRESSURE TRANSMITTER
P4	PIT-20-3-2	PRV STATION LPZ PRESSURE TRANSMITTER
P4	PIT-30-4-1	NORTH BOOSTER STATION LPZ PRESSURE TRANSMITTER
P4	PIT-30-4-2	NORTH BOOSTER STATION HPZ PRESSURE TRANSMITTER
T2	TSL-20-4-1	PRV STATION ENCLOSURE FREEZE STATE
T7	TIT-30-7-1	NORTH BOOSTER STATION TEMPERATURE TRANSMITTER
Z2	ZS-30-6-1	NORTH BOOSTER STATION INTRUSION DOOR SWITCH

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PART 2 PRODUCTS

2.01 F10 - FLOW SWITCH, THERMAL DISPERSION

A. Manufacturer:
   1. Fluid Components International Model FLT93-B
   2. Or equal.

B. Sensing Element Range:
   1. Water based fluids: 0.010 to 3.0 SFPS [0.003 to 0.9 SMPS].
   2. Hydrocarbon based fluids: 0.010 to 5.0.
   3. Gases: 0.250 to 120 SFPS at standard conditions of 70°F], 14.7psia.

C. Adjustable Response Time: From 0.5 seconds.

D. Process Connections: 3/4 inch Male NPT.

E. Wetted Surface: 316SS 4-inch [102 mm] insertion length.

F. Enclosure Classification: Aluminum enclosure is rated for hazardous location use (Classes I and II, Divisions 1 and 2, Groups B, C, D, E, F and G; and EEx d IIC) and resists the effects of weather and corrosion per NEMA/CSA Type 4X (and equivalent to IP66).

G. Flow Element Operating Conditions:
   1. Temperature: -40° to +350°F [-40° to +177°C]
   2. Pressure:
      a. Liquids to 2000 psig
      b. Gases to 200 psig at -70°F

H. Electrical:
   1. Power Supply: 120vac.
   2. Signal Output: dry contact, 120vac rated.
   3. Alarm Output: de-energized with low flow, adjustable flow set point.

2.02 L7 - LEVEL SWITCH, DRYWELL FLOAT

A. Manufacturer
   1. Contegra Model FS 202
   2. Or equal.

B. Operation: the switch is actuated by a magnet located in the float. As the float rises and falls, the magnetic field passing the switch (in the stem) causes the swich to actuate. The switch operates in either the "normally open" or "normally closed" mode. Selecting the mode is accomplised by removing the retaining clip and reversing the float on the stem.

C. Construction:
   1. PVC, PBT and Buna N construction for chemical resistance.
   2. Selectable relay contactacts - N.O or N.C.
   3. Reed switch for reliable extended service.
   4. Large float displacement
   5. Hermetically sealed reed switch located inside the stem.

D. The float switch assembly (including float, guide, tube and junction box) shall be constructed to NEMA 4X standards. The assembly shall be watertight and submersible to the bottom of the junction box. Unit shall be pre-wired, the only connections required are located in the junction box. Provide mounting hardware as shown on the drawings.

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E. Switch operation shall be reliable under submergence, pressure, or long-term inactivity. Switch shall be normally closed, rated 60 watts. Switching arrangement shall be reversible by inverting the float. Load relay shall be provided in control panel receiving float signal.

F. Where float switch is located in hazardous location, installation shall be intrinsically safe, suitable for use in Class I Division I atmospheres in accordance with the National Electrical Code. Installation shall include an intrinsically safe relay located in the control panel receiving the float signal.

2.03 P4 - PRESSURE TRANSMITTER, GAUGE

A. Manufacturer:
1. Rosemount 3051 Series
2. Endress Hauser PMP 51
3. Foxboro I/A Series
4. ABB 2600T Series
5. Siemens SITRANS Series

B. General:
1. High-performance gauge pressure transmitter with HART based digital communication capabilities.
2. Two-wire, capacitance, piezo-resistive, or silicon strain gauge

C. Construction:
1. The instrument shall be suitable for the following conditions:
   a. Humidity: 0-100 percent relative humidity.
   b. Ambient Temperature Limits: -40 to 185 degrees F.
2. Transmitter shall have dual-compartment housing with a moisture barrier completely isolating the electronic circuitry from the field wiring and calibration terminals.
3. Process-Wetted Parts:
   a. Drain/Vent Valves: 316 SST or Hastelloy C
   b. Process Flanges and Adapters: Plated carbon steel
   c. Wetted O-rings: Glass-filled TFE
4. Non-Wetted Parts:
   a. Electronics Housing: Low-copper aluminum
   b. Sensor Module Housing: CF-3M (Cast version of 316L SST, material per ASTM-A743)
   c. Bolts: 316SST
5. Sensor Module Fill Fluid: Silicone or inert halocarbon
6. Paint: Polyurethane
7. Cover O-rings: Buna-N
8. Isolating Diaphragm Material: 316L SST

D. Process Conditions:
1. Suitable for liquid, gas, and vapor service.
2. Process Temperature Limits:
   a. Silicone fill: -40 to 250 degrees F.
   b. Inert fill: 0 to 185 degrees F.
3. Overpressure Limit: 4,500 psig.

E. Measurement Ranges:
1. 2.5 in-H2O to 10,000 psig

F. Outputs:
1. Outputs shall be a 4-20 mA analog signal, user-selectable linear or square root, with a superimposed digital signal, using HART Protocol.
2. Analog output shall be adjustable remotely with a field communicator or control system.
3. Zero and span adjustments shall also be available on the transmitter.

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G. Performance:
1. The transmitter shall meet the following performance criteria as a minimum:
a. Total Performance: +/-0.15 percent of span.
b. Stability: +/-0.125 percent of URL for 5 years.
c. Accuracy: +/-0.075 percent of Calibrated Span.
d. Total Ambient Temperature Effect: +/- (0.0125 percent URL + 0.0625 percent span).
e. Time Response:
1) Dead Time: 45 milliseconds (nominal)
2) Time Constant: 55 milliseconds
3) Update Rate: 20 times per second (minimum)
f. Vibration Effect: +/-0.1 percent of URL when tested from 15 to 2,000 Hz per SAMA PMC 31.1.
g. RFI Effect: Less than +/-0.1 percent of span from 20 to 1,000 MHz for field strength of 30 V/m per IEC 801-3.

H. Electrical:
1. Electrical connections shall be 1/2-inch NPT conduit.
2. Transmitter shall operate on 10.5 to 55 V dc, with no load.
3. Enclosure rating: NEMA 4X (IP65), minimum.

I. Data Storage:
1. Transmitter data shall be stored in nonvolatile EEPROM memory.
2. Sensor module characterization data shall be an integral part of the sensor module.

J. Software Functionality:
1. Transmitter shall be capable of digital communication over the 4-20 mA output loop without disruption, using the HART Communications Protocol.
2. The transmitter shall perform continuous diagnostics, capable of self-test functions and be able to provide specific diagnostic information locally on the meter and remotely.
3. The configuration capabilities of the transmitter shall allow the user the ability to input and store information including the range, engineering units, damping, square root or linear output, drain/vent valves, flange, and O-ring materials, date, message, descriptor, tag number, serial number, and remote seal information.
4. Process variable and sensor module temperature information shall be available digitally.
5. Transmitter software security shall be user selectable.
6. Upscale/Downscale failure mode shall be user selectable.

K. Options:
1. Digital LCD indicator with diagnostic capabilities.
2. Mounting brackets.

2.04 T2 - TEMPERATURE SWITCH, AIR COIL SENSING

A. Manufacturer:
1. Honeywell Model T631C1103
2. Johnson/Controls/Penn Model A19BAC-1
3. Or equal

B. General:
1. Wide range control for applications with air coil sensing element
2. Dustproof NEMA 1 enclosures
3. UL Listed and CSA Certified

C. Specifications:
1. Control Range: 30-100 degrees F
2. Differential: 5 degrees F
3. Switch Type: SPDT

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4. Application: Heating/Cooling
5. Hydraulic Capillary:
    a. Dimensions: 1-3/8-inch by 2-1/4-inch, coiled
6. Inductive Contact Ratings
    a. 120VAC/16A
    b. 240VAC/8A

2.05 T7 - TEMPERATURE TRANSMITTER, AMBIENT

A. Manufacturer:
1. ACI
2. or Equal

B. Equipment Description: Two wire temperature transmitter with local RTD.

C. References:
1. NEMA
2. FM
3. UL

D. Environmental Conditions
1. Sensor Ambient Temperature Limits: -58 - 392 degrees F
2. Transmitter Operating Range: 32 - 158 degrees F.

E. Process Conditions: Measurement of exterior ambient temperature

F. Conduit connetion - 1/2" NPT

G. Power Supply - 7-35V DC with no polar sensitivity

H. Input - 2-wire Platinum 100/1K Ohm Class A RTD

I. Output - 2-wire, Linear 4-20mA DC

J. Performance:
1. Linearity +/- 0.5% of full range span
2. Sensor Accuracy +/- 0.06% at 32 degrees F
3. ccuracy: +/- 0.1% of span
4. Standardization: DIN-EIC-751

K. Enclosure - NEMA 4x

2.06 Z2 - SECURITY DOOR SWITCH, MAGNETIC

A. Manufacturer:
1. GE Sentrol 1078
2. or equal

B. Construction:
1. Recessed magnetic sensor.
2. Rare earth magnet
3. Special design for steel mounting
4. Self-lock mounting
5. Rugged construction
6. 15/16-inch diameter hole required
7. UL approved for specific fire.

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PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 INSTRUMENTATION DEVICES

A. Instrumentation Devices shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Instrumentation Devices, Lump Sum. When so provided, payment for Instrumentation Devices shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Instrumentation Devices, Inclusive. When no quantity is provided, Instrumentation Devices shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 30
PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. ANSI/NFPA 70 - National Electrical Code and state amendments thereto.
      b. ANSI/IEEE C37.90 - IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
   2. CE - European Community, Applicable Directives:
      a. EN50005 - for Terminal Markings.
      b. EN50081-1- Generic Emission Standard.
      c. EN50082-1 - Generic Immunity Standard.
      d. EN61000-4-4 - Electromagnetic compatibility (EMC). Testing and measurement techniques.
      e. EN61000-4-5 - Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
   3. Canadian Standards Association (CSA), Specifications and Standards, current edition:
      a. CSA C22.2, Industrial Control Equipment.
   4. CUL - Underwriter's Laboratories of Canada.
   5. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
      a. IEC1131-1. Programmable Controllers - Part 1: General Information.
      b. IEC1131-2. Programmable Controllers - Part 2: Equipment Requirements and Tests.
      c. IEC1131-3. Programmable Controllers - Part 3: Programming Languages.
      d. IEC1131-4. Programmable Controllers - Part 4: User Guidelines.
      e. IEC1131-5. Programmable Controllers - Part 5: Communications.
      f. IEC 60529 - Classification of Degrees of Protection Provided by Enclosures
   6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
      a. NEMA ICS 2- Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
      b. NEMA ICS 3- Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC.
   7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL508 - Industrial Control Equipment.
      b. UL508A - Industrial Control Panels.
      c. UL94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control

B. Equip programmable logic controller systems with I/O as scheduled on the drawings.

C. Software Configuration Rights:

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1. The software configuration files shall become the property of the owner. Identify all protection methods and turn over all keys and passwords to the owner.
2. System supplier shall draft an agreement with the owner, to be reviewed by the engineer, identifying any consequences arising from modifications to the configuration files not authorized in writing by the system supplier during the specified warranty period. This agreement will be signed by the owner and supplier and copies of the document distributed to all parties. Unauthorized modifications to software configuration during the warranty period will result in a void warranty.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for programmable logic controllers:
1. Software configuration consisting of data tables, ladder logic, and other parameters.
2. Identify coordination requirements with other sections.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for programmable logic controllers:
1. As-built printout of all software configuration including data tables, ladder logic, passwords, and other parameters. Document software with English language descriptions and tag numbers where appropriate.
2. Electronic documentation shall include fully annotated electronic copies of all PLC programs . As-built documentation shall include all changes made during the first year of operation.
3. Software configuration files shall be included in the manual in two forms:
   a. CD ROM.
   b. Paper.

D. Submit software license certificates, manufacturer provided software documentation, and software installation media.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Supply one spare 24VDC discrete input/output module of each type supplied for this project

C. Supply one spare 24VDC analog input/output module of each type supplied for this project

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers:
   1. Allen-Bradley/Rockwell Automation
   2. Without Exception

2.02 GENERAL SYSTEM REQUIREMENTS

A. Common Hardware Specifications
   1. Environmental
      a. Ambient Temperature Rating:
         1) Operating: 0 to 60 degrees C
         2) Storage: -40 to 85 degrees C
      b. Humidity: 5 to 95 percent non-condensing
      c. Shock:
         1) Operating: 30 Gs (3 pulses, 11 mS)
         2) Non-operating: 50.0 Gs (3 pulses, 11 mS)
      d. Vibration:
         1) Vibration Operating: 5.0 G at 10 to 500 Hz
      e. Electromagnetic Compatibility:
         1) ESD immunity - 6kV contact discharges, 8kV air discharges
         2) EFT / B immunity - +/- 4 kV at 5kHz on power ports, +/- 2 kV at 5 kHz on ethernet ports
         3) Surge transient immunity - +/- 1 kV line-line and +/- 2 kV line -earth on power ports, +/- 2 kV line- earth on Ethernet ports
         4) Conducted RF immunity - 10V rms with 1kHz sine wave 80% AB from 150 kHz - 80 MHz
         5) Radiated Electromagnetic Susceptibility: 10V/m with 1kHz Sine wave to 2000 MHz,3V/m with 1 kHz sine wave from 2000 MHz - 2700 MHz
         6) Voltage variation - 10 ms interruption on MOD power port
   2. Safety:
      a. Dielectric Withstand: 1500VAC per UL 508, CSA C22.2
      b. Isolation between communication circuits: 500VDC
      c. Isolation between backplane and I/O: 1500VAC
      d. Flammability and Electrical Ignition: UL94V-0
      e. Certification:
         1) UL listed
         2) CSA certified
         3) CUL listed
         4) Class 1, Division 2, Groups A, B, C or D,

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5) CE compliant for all applicable directives

B. Configuration
1. The programmable controller, associated I/O, chassis, and power supplies shall be of a modular design. The programmable controller and I/O modules shall mount into the chassis
2. Processor Systems shall include processor, power supply, input/output modules, communication modules, and remote interface modules as required to meet system requirements.
3. Remote Input/Output Units shall include input/output modules, interface modules, communication modules, and power supply to meet system input and output requirements.
4. Modules are to be supplied as specified unless system requirements dictate the use of alternative modules.

C. Selection
1. The programmable controller shall be selected from a family of programmable controllers with memory capability ranging up to 10 Mbytes.
2. All system and signal power to the controller and support modules shall be distributed on a single motherboard or backplane.
3. All system modules including the processor shall be removable from the chassis or inserted in to the chassis while power is being supplied to the chassis without faulting the processor or damaging the modules.
4. All system modules and chassis shall be designed to provide for free airflow convection cooling.
5. Modules shall be designed to plug into a chassis and to be keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong slot or chassis via an electronic method for identifying a module. Electronic keying shall perform an electronic check to insure that the physical module is consistent with what was configured for the corresponding slot.

D. Programming:
1. Minimum Programming Instruction Set:
a. Language Characteristics: Ladder diagram
b. Logic Operations: AND, OR, XOR, NOT
c. Register Operations: Store, recall
d. Math Operations: Addition, subtraction, multiplication, division, square root, matrix operations
e. Process Control: Proportional-Integral-Derivative

2.03 PROGRAMMABLE LOGIC CONTROLLER SYSTEM - TYPE I, COMPACT LOGIX PLATFORM

A. Processor Unit:
1. Manufacturer:
a. Allen-Bradley Compact Logix 5380 L3, Model 5069-L310ER - As required by application (maximum of 8-I/O Cards).
2. Processor Memory:
a. User memory of 1, 2, or 3 Mbytes as dictated by the application. Compact flash memory card shall provide 1 Gb non-volatile memory.
b. All user memory in the processor not used for program storage shall be for the purpose of data storage.
3. Performance:
a. Capability of controlling up to 8, 16, 31 I/O modules
b. Typical Throughput Time of 0.08 ms/K based upon a 1K ladder logic program consisting of simple ladder logic and communications servicing
c. Bit Execution Time of less than 0.51 microseconds
d. Proportional Integral Derivative Control with up to 451 microsecond execution time
e. Online programming including runtime editing
4. Features:
a. Standard RAM Memory Back-up provided through minimum two year lithium battery
b. LED indicators for: POWER, RUN, CPU Fault, Forced I/O, Battery Low, DH485, RS-232

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c. One USB port
d. Two Ethernet/IP port
e. Real Time Clock
f. Key Switch Positions for Remote, Program and Run

B. Discrete Input and Output Modules:
1. Manufacturer:
a. 16-Point, 24VDC Input Module: Allen-Bradley Model 5069-IB16
b. 16-Point, Contact Output Module: Allen-Bradley 5069-OW16
2. 16-Point, 24VDC Input Module:
a. Input ratings of 4...7.4mA per channel @ 10...32VDC
b. Sixteen non-isolated Inputs
c. Removable terminal block
1) Terminal identification diagram one each module
2) Terminal blocks to have barriers on 3 sides
3) Optical isolation between digital and field circuits
4) Wiring terminals with self-lifting pressure plates to secure two No.14 AWG wires
d. LEDs to indicate the status of each I/O point
e. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.
3. 16-Point, Contact Output Module:
a. Voltage rating of 5 to 125VDC
b. Provide signal isolation where needed.
c. Continuous current rating per point: 2A AC per channel
d. Continuous current rating per module: 8 A AC per group and 16A per module
e. Removable terminal block:
1) Terminal identification diagram on each module
2) Terminal blocks to have barriers on 3 sides
3) Optical isolation between digital and field circuits
4) Wiring terminals with self-lifting pressure plates to secure two No.14 AWG wires
f. LEDs to indicate the status of each I/O point
g. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

C. Analog Input and Output Modules:
1. Manufacturer:
a. Analog Input Module, Differential: Allen-Bradley Model 5069-IF8
b. Analog Output Module, Isolated: Allen-Bradley Model 5069-OF4
2. Differential Analog Input Module:
a. Eight input channels per module
b. Ratings:
1) Current Rating of 0 to 20mA, 4 to 20mA
2) Voltage Rating of Plus/Minus 10VDC, 0 to 10VDC, 0 to 5VDC,
3) Current Terminal Impedance:
(a) Current Rating of 70 - 110 Ohms
(b) Voltage Rating of >1M ohm
4) Resolution of 16 bits
c. Overall Accuracy:
1) Current Terminal Rating of Plus or Minus 0.3 percent full scale at 25 degrees C
2) Voltage Terminal Rating of Plus or Minus 0.2 percent full scale at 25 degrees C
d. Input channel configuration via configuration software screen or the user program
e. Input Group to Bus Isolation of 500VAC for (1) minute
f. Removable terminal block:
1) Terminal identification diagram one each module
2) Terminal blocks to have barriers on 3 sides
3) Wiring terminals with self-lifting pressure plates to secure two No.16 AWG wires
g. LEDs to indicate the status of each I/O point

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h. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

3. Analog Output Module:
   a. Four output channels per module
   b. Provide signal Isolation where needed
   c. Ratings:
      1) Current Rating of 0 to 20mA, 4 to 20mA
      2) Voltage Rating of Plus/Minus 10VDC, 0 to 10VDC, 0 to 5VDC
   d. Loading:
      1) Inductive load of 1 mH maximum for current outputs
      2) Resistive load of 500 Ohm on current output, 1000 Ohm on Voltage output
      3) Capacitive load of 1 miroF maximum for voltage outputs
      4) Current load of 10mA maximum on voltage output
   e. Resolution of 16 bits
   f. Overall accuracy:
      1) Plus or minus 0.1 percent full scale at 25 degrees C for current terminal
      2) Plus or minus 0.1 percent full scale at 25 degrees C for voltage terminal
   g. Open and short-circuit protection:
      1) Output voltage protection
      2) Input Group to Bus Isolation of 500VAC for (1) minute
   h. Removable terminal block:
      1) Terminal identification diagram one each module
      2) Terminal blocks to have barriers on 3 sides
      3) Wiring terminals with self-lifting pressure plates to secure two No.16 AWG wires
   i. LEDs to indicate the status of each I/O point
   j. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

D. Power Supplies:
   1. Manufacturer
      a. Allen-Bradley Model 5069-FPD - as needed for multiple SA Power busses (AC or DC as required)
      b. Provide MOD External Power Supply - 24VDC - 10A max
      c. Provide SA External Power Supply - if 24DC - 10A max per buss.
   2. Selection Requirements:
      a. Select capacity of power supply for each Power Supply based on requirements of modules installed in rack with 20 percent of power supply capacity reserved for future.
      b. Provide separate Power supplies for Panel requirements and PLC requirements

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

B. Provide interconnect cables of the appropriate type as needed.

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3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.05 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 PROGRAMMABLE LOGIC CONTROLLERS

A. Programmable Logic Controllers shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. Programmable Logic Controllers, Lump Sum. When so provided, payment for Programmable Logic Controllers shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. Programmable Logic Controllers, Inclusive. When no quantity is provided, Programmable Logic Controllers shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 41
LICENSE-FREE SPREAD SPECTRUM ETHERNET RADIO EQUIPMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
      a. NFPA70 - National Electrical Code.
   2. Federal Communications Commission (FCC), Rules and Regulations:
      a. Part 15: Radio Frequency Devices.
   3. Industry Canada (IC), Specifications and Standards, current edition:
      a. IC RSS-210: Low Power Intentional Radiators.
   4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
      a. UL508 - Industrial Control Equipment.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of:
   1. Section 26 90 00 - Process Instrumentation & Control.
   2. All work associated with the provision of the radio system shall be completed by the Radio System Supplier
      a. Radio Path Analysis - both computer generated and physical field verification as described below.
      b. All Radio configuration for communication and security shall be responsibility of Radio System Supplier. PLC messaging shall be responsibility of System Integrator
      c. Purchase of Radio equipment shall be the responsibility of the System Integrator.
      d. All Radio System installation including antennae, antennae cables, and masts shall be the responsibility of the Radio System Supplier.
      e. Installation of Radios in the panel shall be the responsibility of System Integrator.

1.04 RADIO COMMUNICATION SYSTEM PATH ANALYSIS

A. The System Integrator specified under Section 26 90 00 - Process Instrumentation & Control shall perform or shall retain the services of a firm qualified to perform a radio communication path analysis. The radio communication path analysis shall consist of reports from a computer generated propagation model along with actual field verification of the anticipated radio infrastructure. The field reports shall verify predicted radio paths, radio system configuration, and signal strengths. Refer to Shop Drawings for submittal requirements.

B. Verify the performance predicted by the path analysis with actual field measurements of the performance of the permanently installed system. Refer to Operation and Maintenance Manuals and Instructions for submittal requirements.

C. Prior to any construction of the radio system - System Integrator or qualified firm shall verify the performance predicted by the computer path analysis with actual field measurements of the performance of the anticipated installed system. Refer to Shop Drawings for submittal requirements.

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D. Provide repeater functions at locations required by the results of the path study. It shall be the responsibility of the System Integrator to provide appropriate equipment and radio antennas mounted at the appropriate heights to obtain satisfactory radio communications. The System Integrator shall be responsible for coordinating exact antenna installation requirements with the installing contractor.

E. System Integrator shall provide recommendations to best communicate at each site and verify performance of their recommendations before construction.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for License-free Spread-Spectrum Ethernet Radio Equipment:
1. Radio path study results.
2. Proposed mounting heights and locations for antennas.
3. Proposed antenna type, mounting heights, and locations.
4. Anticipated communication rates and data usage (if applicable).

1.06 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for License-free Spread-Spectrum Ethernet Radio Equipment:
1. Radio path study results.
2. Comparison of radio path study results with actual field measurements of the performance of the permanently installed system.

1.08 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

E. All radios shall be manufactured in the United States of America and the manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

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1.09 WARRANTY

A. See Division 01 for additional requirements.

1.10 EXTRA MATERIALS

A. See Division 01 for additional requirements.

B. Supply one spare radio of each type supplied for this project

PART 2 PRODUCTS

2.01 900MHZ, LICENSE-FREE SPREAD SPECTRUM ETHERNET RADIO

A. Manufacturer
1. System Integrator must coordinate with the Owner to match the proposed radio make and model with the current radio system currently being installed.

B. Radio
1. 900 MHz ISM
   a. Technology: Point-multipoint
   b. Operating Modes: Access Point, Remote, Store & Forward
   c. Data Rates/Sensitivity (1x10-6 BER)
      1) 125 Kbps/-105 dBm
      2) 250 Kbps/-103 dBm
      3) 500 Kbps/-99 dBm
      4) 1.0 Mbps/-95 dBm
      5) 1.25 Mbps/-95 dBm
   d. Average latency: < 10 msec one-way
   e. Output Impedance: 50 Ohms
   f. Frequency: 902-928 ISM Band
   g. Spreading method: FHSS, DTS
   h. Occupied Bandwidth: 152 to 1320 kHz
   i. Modulation: 2, 4-level GFSK
   j. Dwell Time: 10-300 msec
   k. Number of Channels: Up to 80
   l. Carrier Power: 100 mW - 1W
   m. Range: Up to 30 miles
   n. Max SAF Hops: Up to 8 hops
   o. Media Access: Proprietary design with Patent Pending Interference avoidance
      1) Error Detect, Retransmit
      2) Auto Repeat
      3) Dynamic fragmentation
2. Cellular 3G
   a. Protocol/Frequency: GSM, GPRS, EDGE,HSPA+
      1) 850/900/1800/1900 MHz
      2) UMTS, HSPA, HSPA+
      3) 800/850/900/
      4) 1700/1900/2100 MHz
   b. Region/Carrier
      1) Global
      2) PTCRB, GCF certification
      3) Regional carrier certifications
   c. Max Throughput
      1) 21 Mbps downlink
      2) 5 Mbps uplink
   d. Typical Throughput

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1) 5.5 Mbps downlink
2) 0.3 Mbps uplink

3. Cellular 4G
   a. Protocol/Frequency
      1) LTE Release 8
      2) 700MHz
      3) CDMA
      4) Band class 0 (850 MHz)
      5) Band class 1 (1900 MHz)
   b. Region/Carrier: U.S. Verizon
   c. Max Throughput
      1) 50 Mbps downlink
      2) 25 Mbps uplink
   d. Typical Throughput
      1) 21 Mbps downlink
      2) 10 Mbps uplink
4. WiFi
   a. Standard IEEE: 802.11 b/g/n
   b. Operating Modes: Access Point, Station
   c. AP Networking: Dual SSID with VLAN mapping
   d. Security
      1) WPA/WPA2 PSK, Enterprise
      2) SSID hiding
   e. Carrier Power: 20dBm
   f. If Radio does not have WiFi capabilities a seperate High Speed Wireless access point is to be provided as specified.

C. Protocols
1. Networking
   a. Layer 2 bridging
   b. Layer 3 routing, QoS
2. Ethernet: IEEE 802.3, Spanning Tree (Bridging), VLAN, IGMP, TCP/IP, DHCP, ICMP, UDP, TCP, ARP, NTP, FTP, SFTP, TFTP, DNS
3. Serial
   a. TCP server, TCP client
   b. UDP U nicast and Multicast
   c. Terminal Server for any asynchronous serial protocol
   d. Modbus TCP to RTU conversion

D. Physical Interfaces
1. Ethernet
   a. 10/100BaseT, RJ-45
   b. Integrated Switch
2. Serial: RS-232/RS-485, RJ-45
3. USB: 2.0 Management Port
4. Antenna Ports
   a. 900 ISM: TNC
   b. WiFi: RP-SMA
   c. Cellular: SMA
5. LEDs: PWR, ETH, COM, NIC1, NIC2

E. Electrical
1. Input Voltage: 10 - 60 Volt DC
2. Power Consumption at 13.8 VDC
   a. MCR 900 (NOMINAL, OUTPUT POWER = 1W, 25C)
      1) AP (Idle): 4.0W/293mA
      2) AP (50% Duty): 5.3W/382mA

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3) Remote (Idle): 3.2W/235mA
4) Remote (50% Duty): 5.0W/365mA

b. MCR 3G (NOMINAL, 25C)
1) Connected (Idle): 2.5W/182mA

c. Connected (Typical Download): 3.2W/235mA

d. MCR 4G (NOMINAL, 25C)
1) Connected (Idle) 4.0W/292mA
2) Connected (Typical Download): 4.3W/310mA

F. Mechanical
1. Case: Die Cast Aluminum
2. Dimensions: 4.4 H x 20.3W x 12.2 D cm. (1.75 H x 8.0 W x 4.8 D in.)
3. Weight: 2 lbs
4. Mounting Options
a. Integrated DIN Rail mount
b. Standard Mounting bracket

G. Environmental
1. Temperature: -40? to 70? C (-40? to 158? F)
2. Humidity: 95% at 60? C (140? F) non-condensing

H. Management
1. HTTP, HTTPS, SSH, NETCONF, local console
2. SNMPv1/v2/v3, MIB-II, Enterprise MIB
3. Syslog and Syslog-over-TLS
4. MDS PulseNET compatible

I. Agency Approvals
1. FCC Part 15
2. IC
3. ETSI / CE (3G and WiFi models)
4. CSA Class 1, Div. 2, UL 508, UL 1604
5. IEEE 1613

J. Cyber Security Suite
1. Tunneling: IPSec VPN
2. 900 ISM Encryption: AES-CCM 128/256 bit with auto key rotation
3. Authentication: RADIUS, PSK, EAP/TLS, PKI
4. Firewall
a. Stateful Packet Inspection
b. Access Control Lists, NAT
5. Certificates: X.509, SCEP, PEM, DER
6. Boot Security: Digitally signed firmware

2.02 YAGI DIRECTIONAL ANTENNA - REMOTE SITE

A. Manufacturer:
1. Microwave Data Systems, Inc. Model Clearwave
2. Antenex Model Y8966
3. Or equal

B. General:
1. Radiator Material: 3/8 inch, solid 6061-T6 aluminum
2. Lightning Protection: DC grounded
3. Wind Survival: 100 mph
4. Maximum Mount Pipe Diameter: 1-5/8 inch
5. Mounting Hardware: stainless steel, included

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6. Factory assembled and tuned
7. Gold anodized, fully welded

C. Electrical Specifications
1. Frequency Range: 896-970 MHz
2. Factory Tuned Frequency: 898 MHz
3. Gain: 9.2dB
4. Bandwidth at 1.5:1 VSWR: 20 MHz
5. Maximum Power: 300 watts
6. Horizontal Beam-width at 1/2 Power: 56 degrees
7. Vertical Beam-width at 1/2 Power: 48 degrees
8. Nominal Impedance: 50 Ohms
9. Front to Back Ratio: 16dB
10. Termination: N female

D. Mechanical Specifications
1. Elements: 6
2. Weight: 2.0 lbs
3. Boom Length: 27-3/4 inches
4. Boom Diameter: 7/8 inch

2.03 OMNI-DIRECTIONAL ANTENNA - MASTER/REPEATER STATION

A. Manufacturer
1. Microwave Data Systems, Inc. Model 97-3194A17
2. Maxrad Model MFB-8967
3. Or equal

B. General Specifications:
1. Radome Material: 0.65 inch pultruded white fiberglass
2. Radiator Material: Coated steel wire
3. Lightning Protection: DC grounded
4. Wind Loading: 100 mph
5. Mounting Base Diameter: 1-5/16 inch
6. Mounting Method (as appropriate):
7. Heavy duty mast mount
8. Cast mount bracket
9. Wall mount bracket for antennas over 30 inches tall

C. Electrical Specifications:
1. Frequency Range: 896-940 MHz
2. Frequency Factory Tuned: 898 MHz
3. Gain: 7dB
4. Bandwidth at 1.5:1 VSWR: 20 MHz
5. Maximum Power: 150 Watts
6. Vertical Beamwidth at 1/2 Power: 17 degrees
7. Nominal Impedance: 50 Ohms
8. Polarization: Vertical
9. Termination: N male with 16 inch jumper

D. Mechanical Specifications:
1. Bending Moment: 62.5 ft-lbs
2. Height: 96 inches
3. Lateral Thrust: 15.8 lbs
4. Weight: 4.00 lbs

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2.04 ANTENNA CABLES

A. Low attenuation cables (as required by the application):
   1. Manufacturer:
      a. Andrew LDF Series Heliax
      b. Or equal
   2. Electrical:
      a. Impedance: 50 ohms
      b. Maximum frequency: 8.8 GHz
      c. Velocity, percent: 88
      d. Peak Power Rating: 40 kW
      e. DC resistance, ohms/1000 ft (1000 m):
         1) Inner: 0.45 (1.48)
         2) Outer: 0.58 (1.90)
      f. DC breakdown: 4000 volts
      g. Jacket Spark: 8000 volts RMS
      h. Capacitance: 23.1 (75.8) pf/ft (m)
      i. Inductance: 0.058 (0.19) pH/ft (m)
   3. Mechanical:
      a. Outer conductor: Copper
      b. Inner conductor: Copper-clad aluminum
      c. Diameter over jacket: 0.63 (16) in. (mm)
      d. Diameter over copper outer conductor: 0.55 (14) in. (mm)
      e. Diameter inner conductor: 0.189 (4.6) in. (mm)
      f. Nominal inside transverse dimensions: 1.11 cm
      g. Minimum bending radius: 5 (125) in (mm)
      h. Number of bends: 15 (50) minimum (typical)
      i. Bending moment: 2.8 (3.8) lb-ft (N-m)
      j. Cable weight: 0.15 (0.22) lb/ft (kg/m)
      k. Tensile strength: 250 (113) lb (kg)
      l. Flat plate crush strength: 110 (2.0) lb/in (kg/mm)

B. Standard attenuation cables (as required by the application):
   1. Manufacturer:
      a. Coleman Cable: RG-213/U coaxial cable
      b. Or equal
   2. Electrical properties:
      a. Maximum conductor resistance: 0.17 ohms/100 ft
      b. Impedance: 50 ohms
      c. Maximum capacitance: 32.2 pF/ft
      d. Velocity of propagation: 66 percent
      e. Maximum Attenuation: 4.7 db/100 ft
   3. Construction parameters:
      a. Conductors: 12.5 AWG stranded bare copper
      b. Dielectric: solid polyethylene color natural
      c. Shielding: 95 percent bare copper braid
      d. Jacket: PVC (Non-contaminating vinyl Type II)
      e. Overall oter diameter: 0.405 in

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

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3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

B. Install antennas at heights determined by system integrator.

C. Install properly terminated connectors and antenna cables of the required length.

D. Aim antennas to obtain optimal radio communication.

3.04 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

B. Configure all radio equipment for proper operation.

C. Configure radio equipment for diagnostic interface with SCADA system equipment.

3.05 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 LICENSE-FREE SPREAD-SPECTRUM ETHERNET RADIO EQUIPMENT

A. License-free Spread-Spectrum Ethernet Radio Equipment shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

1. License-free Spread-Spectrum Ethernet Radio Equipment, Lump Sum. When so provided, payment for License-free Spread-Spectrum Ethernet Radio Equipment shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Conditions - Division 1.
2. License-free Spread-Spectrum Ethernet Radio Equipment, Inclusive. When no quantity is provided, License-free Spread-Spectrum Ethernet Radio Equipment shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 50
SCADA SYSTEM HARDWARE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. ANSI/ISA-5.1-1984 - Instrumentation Symbols and Identification .
      b. ANSI/ISA-5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
      c. ANSI/ISA-95.00.01-2000 - Enterprise Control System Integration, Part 1: Models and Terminology.
      d. ANSI/ISA-TR99.00.01-2004, Security Technologies for Manufacturing and Control Systems.
      e. ANSI/ISA-TR99.00.02-2004, Integrating Electronic Security into the Manufacturing and Control Systems Environment.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of: .
   1. Section 26 90 00 - Process Instrumentation & Control.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for human-machine interface equipment:

D. Submit software license certificates, manufacturer provided software documentation, and software installation media.

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1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

PART 2 PRODUCTS

2.01 TABLET-SCADA SYSTEM REMOTE ACCESS DEVICE

A. Manufacturer: Apple IPAD Pro 11" - Wi-Fi + Cellular.

B. Hardware:
1. Memory: 64GB.
2. Monitor: 10.5"-inch, integral digital flat panel display.

C. Computer Software:
1. Refer to Contract Drawings for installed software requirements.

D. Accessories:
1. Power supply and cords.
2. Ruggedized case.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

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3.04 SOFTWARE CONFIGURATION SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

B. Refer to the requirements of Section 26 90 51 - SCADA System Software.

3.05 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.06 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 SCADA SYSTEM HARDWARE

A. SCADA System Hardware shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.
   1. SCADA System Hardware, Lump Sum. When so provided, payment for SCADA System Hardware shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
   2. SCADA System Hardware, Inclusive. When no quantity is provided, SCADA System Hardware shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 26 90 60
ETHERNET NETWORKING EQUIPMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
   1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
      a. ANSI/ISA-5.1-1984 - Instrumentation Symbols and Identification .
      b. ANSI/ISA-5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
      c. ANSI/ISA-95.00.01-2000 - Enterprise Control System Integration, Part 1: Models and Terminology.
      d. ANSI/ISA-TR99.00.01-2004, Security Technologies for Manufacturing and Control Systems.
      e. ANSI/ISA-TR99.00.02-2004, Integrating Electronic Security into the Manufacturing and Control Systems Environment.
   2. Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Specifications and Standards, current edition:
      a. TIA/EIA-568-A - Commercial Building Telecommunications Wiring.
      b. TIA/EIA-569-A - Commercial Building Standards for Telecommunications Pathways and Spaces.
      c. TIA/EIA-606 - Documentation.
      d. TIA/EIA-607 - Commercial Building Bonding and Grounding Requirements.
      e. TIA/EIA TSB-67 - Transmission Performance for Field Testing of Unshielded Twisted Pair Cabling Systems.
      f. TIA/EIA TSB-72 - Centralized Optical Fiber Cabling Guidelines.
      g. TIA/EIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant.
      h. TIA/EIA-429-AAA - Detail Specification for 62.5 - UM Core Diameter/125-UM Platting Diameter Class 1A Multimode, Graded Index Optical Wave Guide Fibers.

1.03 DESCRIPTION OF WORK

A. For the purpose of obtaining a complete and integrated process instrumentation and control system, the work specified herein shall be included under the scope of: .
   1. Section 26 90 00 - Process Instrumentation & Control.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Submit shop drawings for the equipment specified herein as part of the complete, integrated submittal for the process instrumentation & control system and in accordance with the requirements specified under Section 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for Ethernet networking equipment:
   1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
   2. Identify all software licensing requirements.

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1.05 FACTORY TESTING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. Submit operation & maintenance manuals and instructions in accordance with Division 01.

B. Submit operation and maintenance manuals for the equipment specified herein as part of the complete, integrated manual for the process instrumentation and control system and in accordance with the requirements specified under 26 90 00 - Process Instrumentation & Control.

C. Submit the following information specifically for Ethernet Networking Equipment:
   1. As-built printout of all software configuration including data tables, passwords, and other parameters.
   2. Connection diagrams for each individual piece of equipment.
   3. Complete riser diagram indicating all equipment and interconnecting components with indication of location of each device.
   4. Provide copy of written warranty.
   5. Complete test report for category 6 cabling. Provide test form which includes the following:
      a. Date and time of:
         1) Cable installation.
         2) Cable termination.
         3) Testing report.
      b. Testing equipment used information including:
         1) Make.
         2) Model.
         3) Date of calibration.
      c. Name of person performing test and the installers.
      d. Provide in spreadsheet format. Cable number with test reporting of cable length at near-end crosstalk and attenuation at frequency MHz at 1, 4, 10, 20 and 100. Also indicate room number of each jack.
   6. Submit software license certificates, manufacturer provided software documentation, and software installation media.

1.07 QUALITY ASSURANCE

A. All materials, equipment, and parts shall be new and unused of current manufacture.

B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Division 01 for additional requirements.

1.09 EXTRA MATERIALS

A. See Division 01 for additional requirements.

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PART 2 PRODUCTS

2.01 INDUSTRIAL ETHERNET NETWORK SWITCH, UNMANAGED

A. Manufacturer:
   1. N-TRON Corp. Model 108TX
   2. or equal

B. General
   1. High Reliability/Availability
   2. Extended Environmental Specifications
   3. Rugged DIN-Rail Enclosure
   4. High Performance
   5. MTBF greater than 128.1 years
   6. Ease of Use
      a. Plug & Play Operation
      b. Auto-sensing 10/100BaseT
      c. Auto-sensing Full/Half Duplex
      d. Auto Cable Sensing (MDIX)
      e. Unmanaged Operation
      f. Compact DIN-Rail Package
   7. Increased Performance
      a. Full Wire Speed Capable
      b. Full Duplex Capable
      c. Eliminates Network Collisions
      d. Increases Network Determinism

C. Switch Properties
   1. Number of MAC Addresses: 4,000
   2. Aging Time: Programmable
   3. Latency Min.: 2.2 us
   4. Backplane Speed: 2.6Gb/s
   5. Switching Method: Store & Forward

D. Shock & Vibration
   1. Shock: 15g @ 11ms
   2. Vibration/Seismic: 1g, 9-150Hz, Triaxial

E. Electrical
   1. Input Voltage: 10-30 VDC
   2. Input Current: 200 mA@ 24V
   3. Heavy-duty, industrial power supply, rack-mounted.

F. Environmental
   1. Operating Temperature: 0 to 60 degrees C
   2. Storage Temperature: -40 to 70 degrees C
   3. Operating Humidity: 10 to 95 percent, non-condensing
   4. Operating Altitude: 0 to 10,000 ft.

G. Network Media
   1. 10BaseT: >Cat6 Cable
   2. 100BaseTX: >Cat6 Cable

H. Connectors
   1. 10/100BaseT: eight (8) RJ-45 Copper Ports
   2. Serial Port: Com Parameters 9600,n,8,1

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I. Recommended Wiring Clearance:
   1. Front: 2-inch
   2. Side: 3-inch

J. Emissions and Safety Approvals:
   1. FCC Part 15 Class A
   2. UL Listed (US & Canada)
   3. CLASS I, DIV 2, GROUPS A,B,C,D, T4A
   4. CE: EN55011,EN61000-6-2 and -6-4
   5. EN61000-4-2, 3, 4, 5, 6, 11, EN61010-1
   6. Class III, Pollution Degree2, Installation Category I

2.02 UTP CONTROL CABLE

A. Manufacturer:
   1. Belden DataTwist 3600.
   2. Or equal.

B. General:
   1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 23 AWG, solid bare copper, FEP insulated, bonded-pairs, ripcord, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
   2. Supports Category 6 applications such as 1000 Base TX. Ideal for use in high bandwidth applications such as gigabit Ethernet.
   3. Multimedia applications include AES/EBU digital audio and RS-422 machine control.
   4. Support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video.
   5. UL tested for use with high speed audio-video systems in accordance with FCC Class A digital devices at a fundamental frequency of 135 MHz.
   6. Suitable for "noisy" environments such as running next to power cables and transformers.

C. Physical Characteristics:
   1. Temperature range: -20 TO 75 deg. C.
   2. Insulation material: FEP.
   3. Jacket material: PVC.
   4. Maximum pulling tension: 40 lbs.
   5. Minimum conductor OD: 0.020-in.
   6. Minimum insulation OD: 0.035-in.
   7. Minimum bend radius: 0.25-in.
   8. Flame test: UL 1581 Vertical Tray.
   9. Color code:
      a. Pair 1: white/blue & blue
      b. Pair 2: white/orange & orange
      c. Pair 3: white/green & green
      d. Pair 4: white/brown & brown

D. Electrical Characteristics:
   1. Maximum operating voltage: 300 V rms.
   2. Mutual capacitance (pF/100-m): 5.6 nominal.
   3. Nominal velocity of propagation: 70 percent.
   4. Propogation Delay (Skew) (nS/100-m): 30 nominal.
   5. Velocity of Propagation at 10 MHz (percent): 72 nominal.
   6. Capacitance unbalance (pF/100-m): 90.0 maximum.
   7. DCR at 20C (Ohms/100-m): 7.7 maximum.
   8. DCR unbalance (percent): 3.0 maximum.

E. Usage:

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1. Instrumentation & Control system UTP cable.

2.03 UTP PATCH CABLE

A. Manufacturer:
1. Belden DataTwist 3600.
2. Or equal.

B. General:
1. Non-plenum rated 4 pair UTP (unshielded twisted pair) cable, 23 AWG, solid bare copper, FEP insulated, bonded-pairs, ripcord, flexible PVC jacket. Jacket is sequentially marked at two foot intervals.
2. High flexibility patch cordage. RJ-45 compatible for either T568A or T568B configurations.
3. Design minimizes changes in electrical characteristics due to bending and kinking associated with patch cables.
4. Patch cable impedance is matched with DataTwist 3600 horizontal cables to reduce signal reflections caused by impedance mismatches and decrease system return loss.
5. Resistant to attenuation increases due to high humidity environments.

C. Physical Characteristics:
1. Temperature range: -20 TO 80 deg. C.
2. Insulation material: FEP.
3. Jacket material: PVC.
4. Maximum pulling tension: 40 lbs.
5. Minimum conductor OD: 0.020-in.
6. Minimum insulation OD: 0.035-in.
7. Minimum bend radius: 0.25-in.
8. Flame test: UL 1581 Vertical Tray.
9. Color code:
   a. Pair 1: white/blue & blue
   b. Pair 2: white/orange & orange
   c. Pair 3: white/green & green
   d. Pair 4: white/brown & brown

D. Electrical Characteristics:
1. Maximum operating voltage: 300 V rms.
2. Mutual capacitance (pF/100-m): 5.6 nominal.
3. Nominal velocity of propagation: 70 percent.
4. Propogation Delay (Skew) (nS/100-m): 30 nominal.
5. Velocity of Propagation at 10 MHz (percent): 72 nominal.
6. Capacitance unbalance (pF/100-m): 90.0 maximum.
7. DCR at 20C (Ohms/100-m): 7.7 maximum.
8. DCR unbalance (percent): 3.0 maximum.

E. Usage:
1. Instrumentation & Control system UTP patch cable.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.02 DELIVERY STORAGE AND HANDLING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

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3.03 INSTALLATION

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.04 SOFTWARE CONFIGURATION SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

B. A and C

3.05 TESTING AND START-UP SERVICES

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

3.06 TRAINING

A. Refer to the requirements of Section 26 90 00 - Process Instrumentation & Control.

PART 4 MEASUREMENT AND PAYMENT

4.01 ETHERNET NETWORKING EQUIPMENT

A. Ethernet Networking Equipment shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.
   1. Ethernet Networking Equipment, Lump Sum. When so provided, payment for Ethernet Networking Equipment shall be included with payment for Process Instrumentation & Control and shall be made at the contract lump sum price bid or as specified in Special Conditions - Division 1.
   2. Ethernet Networking Equipment, Inclusive. When no quantity is provided, Ethernet Networking Equipment shall be included with payment for Process Instrumentation & Control and shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 31 05 19.13
GEOSYNTHETICS FOR EARTHWORK

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing geotextile fabrics for subgrade separation and stabilization, and under riprap in accordance with the contract drawings and specified herein, and in accordance with Section 645 of the State of Wisconsin, Department of Transportation, Standard Specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Subgrade Preparation - Division 31

D. Riprap - Division 31

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

B. The Contractor shall furnish to the Engineer at least ten days prior to use in the work a manufacturer's Certified Report of Test or Analysis that the geotextile fabric delivered for use conforms to this specification. The delivered geotextile fabric shall bear markings to clearly identify it with the applicable test report furnished to the Engineer.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

A. The geotextile fabric shall consist of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest principal direction. Nonwoven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof.

B. The geotextile fabric shall be insect, rodent, mildew, and rot resistant.

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C. The geotextile fabric shall be furnished in a wrapping which will protect the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. The geotextile is to be kept dry until installed.

D. The geotextile fabric rolls shall be clearly marked showing the type of fabric.

E. Samples of fabric for testing may be obtained from the job site as specified herein or as determined by the Engineer.

F. If sewn seams are used, the Contractor shall furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment to be used on the project, prior to its incorporation into the work.

G. All numerical values specified below represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

2.02 GEOTEXTILE FABRIC, TYPE R (RIPRAP)

A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	200 min.
CBR Puncture Strength	ASTM D 6241	500 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC^{-1}	ASTM D 4491	0.40 min.

B. Acceptable materials are Geotex 801, Thrace-LINQ 180EX, Mirafi 180N, and US NW 205, or equal.

2.03 GEOTEXTILE FABRIC, TYPE HR (HEAVY RIPRAP)

A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	300 min.
CBR Puncture Strength	ASTM D 6241	800 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC^{-1}	ASTM D 4491	0.40 min.

B. Acceptable materials are Geotex 1201, Thrace-LINQ 275EX, Mirafi 1120N, Mirafi HP370, and US 300 NW, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Installation procedures shall be in accordance with manufacturer's recommendations and as specified herein.

B. Sewing. All factory and field seams shall be sewn with a thread having the same or greater durability as the material in the fabric. A 401 stitch conforming to Federal Standard No. 751a shall be used for all seams. All seams shall develop a tensile strength equal to or greater than 60 percent of the specified grab tensile strength of the fabric, unless otherwise specified.

3.02 GEOTEXTILE FABRIC, TYPE R

A. The area shall be graded smooth and all stones, roots, sticks, or other foreign material which would interfere with the fabric being completely in contact with the soil shall be removed prior to placing the fabric.

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B. The fabric shall be placed loosely and laid parallel to the direction of the water movement. Pinning or stapling may be required to hold the geotextile in place. Separate pieces of fabric shall be joined by overlapping or sewing. The fabric in the overlapped joints shall be placed with a minimum overlap of 24 inches in the direction of the flow.

C. After placement, the fabric shall be exposed no longer than 48 hours prior to covering.

D. Damaged areas shall be covered with a patch of fabric using a 36 inch overlap in all directions.

E. Placement of riprap shall be from the base of the slope upward. Height of free fall of riprap shall be determined by the Engineer but in no case shall this height exceed 12 inches.

3.03 GEOTEXTILE FABRIC, TYPE HR

A. The construction methods for Type HR fabric shall conform to the requirements of Subsection 3.03, except that the height of freefall of riprap shall not exceed 6 inches.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Geosynthetics for earthworks shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SECTION 31 22 00
GRADING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the grading for this project.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Structural Excavation for Structures - Division 31

C. Trenching and Backfilling - Division 31

D. Erosion and Sedimentation Controls - Division 31

E. Topsoil Placement and Grading - Division 32

F. Seeding - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 CONSTRUCTION METHODS

2.01 PROTECTION OF EXISTING UTILITIES

A. Locate existing underground utilities in the areas of work before starting grading operations and provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during grading, consult the Engineer immediately for directions on how to proceed. Cooperate with the Owner, and public and private utility companies in keeping their respective services and facilities in operation.

B. Repair damaged utilities to the satisfaction of the utility owner.

2.02 PRESERVATION OF TREES AND SHRUBS

A. Trees and shrubs to be preserved shall be thoroughly protected from scarring or other injury during grading operations. Excavation operations shall not disturb the original ground around trees within a distance of one foot or twice the diameter of the tree, whichever is greater. Exposed roots resulting from excavation shall be cut cleanly and covered with humus-bearing soil.

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B. When necessary or required by the Contract Documents, trees or shrubs around which embankment is placed shall be protected by tree wells built in accordance with detailed drawings or as laid out in the field by the Owner or Engineer.

2.03 GRADING

A. General. All areas within the project limits shall be graded to the finished grades, lines and details less an allowance for topsoil and/or sod depth, pavement, base and structures.

B. Construction Methods. Grading shall be performed in accordance with Sections 205, 206, 207, and 208, of the State of Wisconsin, Department of Transportation Standard Specifications. If borrow is needed to provide the grades and elevations required, a borrow area will be selected by the Owner. The borrow area shall be restored to smooth lines, topsoiled with a minimum of 6 inches of salvaged topsoil and seeded.

C. Tolerance. Finish earth grades shall be in reasonably close conformity with the lines, grades and thickness shown on the contract drawings or established by the Engineer with particular concern for drainage and appearance. Finish earth grades along buildings or structures, under and adjacent to pavements and in drainageways shall be within 0.10 foot of those staked or shown on the contract drawings. Grades in all other areas shall be within 0.50 foot unless drainage considerations require more accuracy.

2.04 DRAINAGE

A. During construction, ditches and channels shall be drained by keeping the excavation areas and embankment sloped to the approximate section of the final earth grade. If existing surface drainage must be interrupted, temporary drainage shall be provided.

B. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow, or which may result in contamination and/or silting of the stream.

C. Precautions shall be taken to preserve, protect, and continue service of all existing tile drains, sewers, and other subsurface utilities; repair any damage to drains, sewers, and utilities.

PART 3 MEASUREMENT AND PAYMENT

3.01 GENERAL

A. Grading shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

3.02 GRADING

A. Grading, Inclusive. When no quantity is provided, grading shall be inclusive to payment for work associated with related utility or infrastructure improvement.

END OF SECTION

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SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing all material, equipment, and labor required to execute the earthwork for this project in accordance with Sections 201 through 214 of the State of Wisconsin, Department of Transportation Standard Specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Erosion and Sedimentation Controls - Division 31

C. Aggregate Base and Subbase - Division 32

D. Topsoil Placement and Grading - Division 32

E. Seeding - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS (N/A)

PART 3 EXECUTION

3.01 PRESERVATION OF TREES AND SHRUBS

A. Trees and shrubs to be preserved shall be thoroughly protected from scarring or other injury during grading operations. Excavation operations shall not disturb the original ground around trees within a distance of one foot or twice the diameter of the tree, whichever is greater. Exposed roots resulting from excavation shall be cut cleanly and covered with humus-bearing soil.

B. When necessary or required by the Contract Documents, trees or shrubs around which embankment is placed shall be protected by tree wells built in accordance with Detailed Drawings or as laid out in the field by the Owner or Engineer.

3.02 UNCLASSIFIED EXCAVATION AND GRADING

A. Excavation to subgrade shall be performed to provide a finished subgrade prepared for the application of crushed aggregate, curb and gutter, sidewalks and topsoil as shown on the typical section.

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B. Also included is the removal and disposal of existing stumps, trees, miscellaneous structures and rubble as shown on the contract drawings and any other obstructions encountered which interfere with the proposed construction. Stumps shown on contract drawings to be removed from terraces or backslopes shall be shredded to a minimum of 6 inches below finish subgrade or otherwise removed by the Contractor.

C. Driveways shall be graded to a 10:1 maximum slope to match proposed construction.

D. The Contractor shall adjust all valve boxes, manhole frames, and other utility appurtenances to within 1 inch of the final grade as shown on the contract drawings or as staked in the field by the Engineer.

3.03 FILLING

A. All suitable excavated material shall be used for roadway construction, and at other places shown on the drawings.

B. Fill shall be spread in successive uniform horizontal layers not exceeding 9 inches in depth over entire area before compaction. Each layer shall be worked to break down clods over 6 inches in size and to secure uniform moisture content. Where filling in 9 inch layers is not feasible, as in the case of filling in water or over steep slopes, construct fill in one layer to the minimum elevation at which equipment can be operated. Above this elevation, the fill shall be constructed in layers of the specified depth.

C. Compact each layer of fill material to the following percentage of maximum dry density per modified proctor (ASTM D1557).
   1. 91 percent for fine grained soils (more than 50 percent passing the No. 200 sieve).
   2. 93 percent for coarse-grained soils (less than 50 percent passing the No. 200 sieve).

3.04 PREPARATION OF SUBGRADE

A. The preparation of the subgrade shall consist of bringing the area to be paved to a subgrade conforming to the required grade and cross section, of uniform density, ready to receive the base course. This is to be accomplished by excavating or backfilling as needed, shaping, watering as required, or permitting to dry to proper consistency, and rolling the entire area with an approved self-propelled roller weighing not less than 8 tons. Shaping and rolling shall be continued until the subgrade has been properly prepared and shows that no further compaction of any practical benefit would result from continued compaction. The subgrade shall be tested as to cross section, crown, and elevation. After being properly prepared, it shall be so maintained until the base course is constructed. A completed subgrade shall be maintained sufficiently in advance of the base course operations to permit proper control. Any part of the subgrade area not accessible to a roller shall be thoroughly compacted by hand or mechanical compaction in a manner acceptable to the Engineer. This work shall be in accordance with Section 211 of the State of Wisconsin, Department of Transportation Standard Specifications.

3.05 UNSTABLE SUBBASE/EXCAVATION BELOW SUBGRADE (EBS)

A. Deposits of frost-heave material, unstable soils, topsoil containing considerable amounts of organic matter, or other undesirable foundation material shall be removed from the area within the roadbed depths as shown on the drawings or as directed by the Engineer and shall be replaced as directed by the Engineer in the field.

B. Contractor shall notify the Engineer of any questionable material. The work shall be performed in accordance with Section 205 of the State of Wisconsin, Department of Transportation, Standard Specifications.

3.06 DRAINAGE

A. During construction, ditches and channels shall be drained at all times by keeping the excavation areas and embankments sloped to the approximate section of the final earth grade. If existing surface drainage must be interrupted, temporary drainage shall be provided.

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B. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow, or which may result in contamination and/or silting of the stream.

C. Precautions shall be taken to preserve, protect, and continue service of all existing tile drains, sewers, and other subsurface utilities; repair any damage to drains, sewers and utilities.

3.07 TESTING

A. A testing laboratory will perform compaction and density tests at locations determined by the Owner's Authorized Representative. Where tests indicate that the subgrade does not conform to the compaction density specified, the subgrade shall be replaced or re-worked until it does conform.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Subgrade preparation shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SECTION 31 23 16.16
STRUCTURAL EXCAVATION FOR STRUCTURES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable Provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor - Part 1926 Regulations, Current Edition.
   3. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall include all excavation, backfill and compaction for structures and other miscellaneous excavation, backfill and compaction required but not designated under other sections.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Subgrade Preparation - Division 31

C. Trenching and Backfilling - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 INSITU BACKFILL MATERIAL

A. Previously excavated soil or material free of organic debris, clay balls, and aggregate larger than 1-1/2 inches as approved by the Engineer.

2.02 IMPORTED GRANULAR FILL AND GRANULAR FOUNDATION

A. Imported granular fill and granular foundation shall be sand conforming to State of Wisconsin, Department of Transportation, Standard Specifications Section 209.2.2, Grade No. 1 Granular Backfill or well-graded sand and gravel conforming to State of Wisconsin, Department of Transportation, Standard Specifications Section 305.2.2.1 1-1/4 inch dense graded base with not more than eight percent (8 percent) by weight passing a No. 200 sieve.

2.03 PIPE EMBEDMENT

A. Embedment for pipe lines under footings shall be Class B for rigid pipe and Class II for flexible pipe, as applicable for the pipe material to be installed, as specified by ASTM C12 and ASTM D2321 respectively.

PART 3 EXECUTION

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3.01 GENERAL CLASSIFICATION

A. Excavation and trenching of all materials encountered under this contract will be unclassified without regard to type, difficulty to remove, or suitability for use in the construction.

3.02 BARRICADES

A. Provide sufficient barricades and protective devices adjacent to excavations to safeguard against injury. Provide and maintain sufficient safety lanterns at walks, roadways and parking areas to provide safety at night.

3.03 EXCESS MATERIAL

A. To the extent needed, all suitable excavated materials shall be used for foundation backfill and site grading. The suitability of materials for specific purposes shall be determined by the Engineer. All surplus or unsuitable excavated materials will be designated as waste and used only for site grading.

3.04 EXCAVATION

A. Excavate to achieve necessary dimensions, lines, grades and cross sections. Notify the Engineer of any remaining pockets of organic or unsuitable soil, debris, existing foundations or poorly compacted fill soils. Unsuitable materials shall be removed and replaced with compacted granular fill or backfill material. Bottoms of trenches shall be excavated to proper grade so that pipes will be supported on a firm bed of undisturbed natural earth or suitable, compacted backfill.

3.05 UNAUTHORIZED EXCAVATION

A. Consists of removal of materials beyond indicated elevations or dimensions without specific direction of the Engineer. Notify the Engineer when unauthorized excavations are made.

3.06 STABILITY OF EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Provide shoring and bracing to retain banks and prevent collapse of excavations as necessary to safeguard workmen, prevent movement of adjacent ground, and avoid damage to existing improvements.

3.07 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees Fahrenheit.

3.08 PIPE EMBEDMENT

A. Embedment pipe lines under footings shall be performed in accordance with the methods required as Class B for rigid pipe and Class II for flexible pipe, as applicable for the pipe material to be installed, as specified by ASTM C12 and ASTM D2321 respectively.

B. Where fill is required to raise the subgrade to elevations required, it shall be made in horizontal layers not to exceed 8 inches in depth and compacted as specified as herein.

3.09 BACKFILLING AND COMPACTION

A. Place backfill to bring excavations to natural grade unless otherwise noted. Backfill within foundation walls and outside foundation walls to a distance of 10 feet outside the building line and under pavements and walks shall be spread and compacted uniformly in 6 inch to 8 inch lifts to at least 95 percent maximum dry density per modified proctor (ASTM D1557).

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B. Site backfill placed outside a distance 10 feet from the building line shall be spread uniformly in 12 inch maximum lifts and trench backfill and similar work shall be with approved excavated material or granular backfill compacted in 8 inch maximum lifts to 93 percent dry density per modified proctor (ASTM D1557).

C. Backfill shall not be placed against any concrete structure which retains earth until the concrete has been in place 14 days or until test cylinders show the concrete strength to be at least 3000 pounds per square inch, nor shall high-early-strength concrete structures be backfilled before 6 days after the day of pouring or until test cylinders show the strength of the concrete to be at least 3000 pounds per square inch. Concrete structures which have earth on both sides (i.e., footings, frost walls, etc.), may be backfilled uniformly on both sides after the concrete has been in place 4 days, or 2 days for high-early-strength concrete. In no case shall backfilling start before required curing and protection, surface finishing, dampproofing, and waterproofing of the work to be covered by backfilling has been completed. When so permitted by the Engineer, footings may be backfilled uniformly on all sides to the top of such footing immediately upon removal of forms.

D. Contractor shall provide all necessary equipment required to obtain specified compaction. Compaction by travel of grading equipment is not considered adequate for uniform compaction. Small vibratory compactors are required wherever fill is placed adjacent to foundation walls, footings and piers.

E. Backfilling shall be so performed as to prevent wedging action against the structure. Slopes within ten feet of the structure shall be stepped, terraced, or otherwise treated as necessary to prevent slippage and wedging of the backfill.

F. Water shall not be used to expedite settlement of the backfill except to adjust moisture content to optimize compaction. The groundwater level shall be kept below the level of the lift of material being compacted.

3.10 SAMPLING

A. All required sampling, preparing of specimens, and testing except as modified by these specifications shall be performed by an independent laboratory and paid for by the Owner. The laboratory shall meet the requirements of ASTM E329. The Engineer shall determine when compaction tests shall be made.

3.11 TESTING

A. Any testing required because of failure of backfill to meet specification requirements shall be paid for by the Contractor. Test reports shall be sent to the Contractor with copies to the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Structural excavation, backfilling and compaction shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 STRUCTURAL EXCAVATION FOR STRUCTURES

A. Structural Excavation for Structures, Inclusive. When no quantity is provided, structural excavation for structures shall be included in the payment for contract work related to the associated structure.

4.03 IMPORTED GRANULAR FILL AND GRANULAR FOUNDATION

A. Imported Granular Fill and Granular Foundation, Inclusive When no quantity is provided, imported granular fill and granular foundation shall be included in the payment for contract work related to the associated structure.

END OF SECTION

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SECTION 31 23 23.14
GRANULAR FILL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the filling, compaction, and testing of all subgrade excavations for this project.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Subgrade Preparation - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GRANULAR FILL

A. All granular subbase and granular fill materials shall conform to Section 209 of the State of Wisconsin, Department of Transportation, Standard Specifications.

B. Unless otherwise noted in the Contract Drawings or specifications, all Granular Backfill material shall be Grade 1 Backfill in accordance with the gradation requirements of Section 209 of the State of Wisconsin, Department of Transportation, Standard Specifications.

PART 3 EXECUTION

3.01 COMPACTION

A. Granular fill materials shall be mechanically compacted in 6 inch to 8 inch lifts to 93 percent maximum dry density per modified proctor (ASTM-D1557).

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Granular fill shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Part 1926 Regulations, Current Edition.
   3. Wisconsin Administrative Code (WAC), Department of Natural Resources, Environmental Protection, Regulations, Current Edition.
   4. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall include all excavating, trenching, and backfilling for utilities as indicated from the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Dewatering - Division 31

C. Rock Excavation – Division 31

D. Structural Excavation for Structures - Division 31

E. Erosion and Sedimentation Controls - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 INSITU BACKFILL MATERIAL

A. Previously excavated soil free of organic debris, clay balls, and aggregate larger than 1-1/2 inches as approved by the Engineer.

2.02 IMPORTED GRANULAR BACKFILL (TRUCKED BACKFILL) MATERIAL

A. Imported granular fill (trucked backfill) shall be sand conforming to State of Wisconsin, Department of Transportation, Standard Specifications Subsection 209.2.2, Grade No. 1 Granular Backfill or well-graded sand and gravel conforming to Subsection 305.2.2.1 of said State Standard Specification 1-1/4 inch dense graded base with not more than eight percent (8 percent) by weight passing a No. 200 sieve.

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2.03 FLOWABLE BACKFILL

A. A cubic yard of flowable backfill shall consist of 1,350 pounds of sand, 775 pounds of #1 stone, 1,150 pounds of #2 stone, and 25 gallons of water. All weights are damp weights and no additional water will be allowed.

B. The #1 stone shall conform to the gradation of ASTM C33 No. 67 Stone. The #2 stone shall conform to the gradation of ASTM C33 No. 4 stone.

2.04 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. The CLSM shall include fine aggregate, cementious material, and water to produce a flowable, non-shrinking backfill. The strength of the CLSM shall be less than 1200 psi. If future excavation of the area is a possibility, the CLSM shall have a maximum strength of 150 psi. The Contractor shall submit a mix design to the Engineer for approval prior to use.

PART 3 EXECUTION

3.01 SURFACE OBSTRUCTIONS

A. Structures, sidewalk, driveways, curb and gutter, trees, shrubs, lawns, signs, fences, utilities, survey monuments, pavements, culverts and other appurtenances which are adjacent to the right-of-way or work easements, shall be carefully protected against damage. In the event of damage or inadvertent injury or removal of these surface features by failure of the Contractor to exercise reasonable precautions or proper construction techniques, he shall bear the full cost and responsibility for resulting damages and shall replace or repair such damage as early as possible. No allowance for extra payment or time lost will be allowed for such interferences that the Contractor could have suspected or anticipated during pre-bid site inspection and interpretation of the bidding documents.

B. Clearing, grubbing, and removal of all pavements, sidewalks, curbs, signs, poles, fences, etc., shall be done only as necessary for the completion of the work. Brush, trees, shrubs, concrete, rubble, and other removals, which are not intended to be replaced, shall be disposed of by the Contractor off the work site.

C. Obstructions, which are intended to be reset, shall be stored and protected by the Contractor. Fences, signs, mailboxes, trees, shrubs, structures, and similar features requiring removal, shall be restored to their original position except where permanent removal is indicated.

D. Monuments for land surveys encountered in the path of work shall be carefully protected from movement. Should removal be necessary, the Contractor shall notify the Engineer in advance. The Contractor will be held responsible for re-establishing monuments lost due to his negligence or failure to notify the Engineer at least 24 hours in advance of disturbing.

3.02 SUBSURFACE OBSTRUCTIONS

A. The approximate location and size of sewers, drains, culverts, gas mains, water mains, survey monuments, electric and telephone conduits and other underground structures shown on the drawings are based on records available to the Owner or surface markings indicating their existence.

B. The Contractor shall use caution in excavating and trenching so that the exact location of underground structures, both known and unknown, may be determined; he shall be held responsible for the repair of such structures when broken or otherwise damaged during construction.

C. The Contractor shall make arrangements with the utility companies for any relocation of interfering utilities. No extra cost due to unexpected delays or coordination work shall be incurred on the Owner except for authorized utility alterations performed by the Contractor as provided below.

D. When the Engineer permits the Contractor to make a change to avoid a utility relocation, the Engineer shall determine whether the change constitutes extra work as defined in the General Conditions.

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E. Any underground utilities or other structures, which the Contractor wishes to have moved to facilitate construction, shall be arranged with the owner of such structures. The Contractor shall pay all costs of the accommodation.

F. In the event that there is any question as to whether any of the above enumerated obstructions, underground utilities or other structures cross or pass through the space occupied by the completed structures of this contract, the Engineer's decision shall be binding upon the Owner and the Contractor.

G. During the construction of the pipe lines, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits and other underground structures. Where necessary, the flow in drains or culverts shall be diverted so that the excavation is kept dry during the progress of the construction work. Every effort shall be made to prevent damage to such underground structures. Wherever such structures are disturbed or broken, they shall be restored to good condition at no additional cost to the Owner.

H. The Contractor shall use sand or gravel backfill beneath said structures. This backfill shall be deposited and thoroughly compacted by mechanical means in layers not to exceed 6 inches in depth.

3.03 EXCAVATION

A. General. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified.
   1. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as specified. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations and any water accumulated therein shall be removed by pumping or by other approved methods.
   2. Sheeting and shoring shall be placed as may be necessary for the protection of the work and for the safety of personnel. Unless otherwise indicated, excavation shall be by open cut.

B. Trench Excavation. Trenches shall be of the necessary width for proper laying of pipe and shall conform to WAC requirements. The banks of pipe trenches shall conform to OSHA requirements and the Contractor is responsible for all safety requirements of said codes.
   1. Care shall be taken not to overexcavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe. Bell holes and depressions for joints shall be dug after the trench bottom has been graded, and in order that the pipe rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid point bearing.
   2. Except as hereinafter specified for wet or other unstable material, overdepths shall be backfilled as and with materials specified for, backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be overexcavated to a depth to allow for construction of a stable pipe bedding. The trench shall be backfilled to the proper grade with suitable approved materials.
   3. Trench Width. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not be less than 6 inches nor exceed 8 inches on either side of the pipe, unless otherwise approved by the Engineer in writing. The width of the trench above that level shall be as wide as necessary for sheeting and bracing and the proper performance of the work.
   4. Excavation for Appurtenances. Excavation for manholes and similar structures shall be sufficient to leave at least 12 inches clear space between the outer surface of structure and the bank or timber that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with sand, gravel, or concrete, as directed, at no additional cost to the Owner.
   5. Embedment. Embedment for utilities shall be as specified in the respective utility specification section.

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C. Protection and Removal of Utility Lines. The Contractor shall notify all affected utility companies at least three consecutive working days preceding his construction operations to coordinate his work regarding poles, wires, valve boxes and other surface obstructions and to determine the location of gas, water main, power, light, telephone or telegraph conduit or service connection thereto or any other subsurface structure that crosses or passes through the space occupied by any of the proposed improvements. The Contractor shall make advance arrangements with the utility companies for any relocation of interfering utilities so as not to delay construction.

D. Interruptions of Services. Interruptions of utility services to existing buildings or facilities which become necessary either directly or indirectly due to work required under this contract shall be coordinated with the Owner through the Engineer. If the down time for connections is limited by them as to duration and time (weekend, nights or holidays), the Contractor shall perform the work during the designated period at no additional cost to the Owner.

3.04 BACKFILLING

A. Types of Backfill. Backfill for sanitary sewers, water mains, storm sewers, culverts, and drainpipes is the material placed between the bedding and the ground surface. Debris, frozen material, organic matter, unstable material, or stones greater than 8 inches in diameter shall not be suitable for backfill. Large clods and stones not exceeding 8 inches in diameter, when allowed for use as backfill, shall not be placed within two feet of the top of the pipe. Backfill shall be of the following types:

1. Type I Backfill:
   a. Type I backfill shall be used where shown on the contract drawings or stated in Special Procedures - Division 01, and unless directed otherwise shall extend from the top of the embedment to the underside of surface restoration.
   b. Type I backfill shall be used under and around all existing underground structures, tunnels, conduits, and pipes crossing the excavation. Such backfill shall extend underneath and on all sides to a structure, tunnel, conduit or pipe.
   c. Type I backfill shall be selected fill material consisting of granular subbase course, base course or approved existing sand. The backfill material shall be mechanically compacted in 6-inch layers, from a distance of one foot above the pipe to the surface. The degree of compaction shall be to 95 percent maximum dry density per modified proctor (ASTM D1557).
2. Type II Backfill:
   a. Type II backfill shall be used where shown on the contract drawings or stated in Special Procedures - Division 01.
   b. Type II backfill shall be suitable excavated material, or other approved material, placed in uniform layers and mechanically compacted. The following compaction percentages based on the maximum dry density per modified proctor (ASTM D1557) for the materials are required:
      1) For fine grained soils (more than 50 percent passing the No. 200 sieve).
         Zone III: From bottom of surface restoration to 3 feet below - 91 percent
         Zone II: From bottom of Zone III to top of the embedment - 88 percent
         Zone I: Specified as embedment
      2) For coarse grained soils (less than 50 percent passing the No. 200 sieve).
         Zone III: From bottom of surface restoration to 3 feet below - 93 percent
         Zone II: From bottom of Zone III to top of the embedment - 90 percent
         Zone I: Specified as embedment
3. Type III Backfill:
   a. Type III backfill shall be used in all areas where shown on the Plans or stated in Special Procedures - Division 01. Backfill material shall be suitable excavated material placed, from top of embedment to the bottom of surface restoration, in 12 to 18 inch layers and consolidated by jetting, spading, tamping, or puddling, to the approval of the Engineer, to insure complete filling of the trench.
4. Type IV Backfill:
   a. Utilize Type III Backfill with the following jetting: at least a 1-1/2 inch jetting hose, equipped with a regulating valve which permits the hydrant valve to be fully open during use, with a minimum 1-1/2 inch diameter pipe nozzle at least 6 feet long shall be used. During the flooding operation, the nozzle shall be inserted as deeply into the backfill as is

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possible without damaging the sewers, water mains, or foundations. The insertions shall be made at intervals of 5 feet or less and maintained until the backfill is saturated. Depressions caused by flooding shall be backfilled until there is no further settlement.

5. Flowable Backfill:

a. The materials shall be placed in a clean cement mixer truck and thoroughly mixed. Just prior to placement, the mixer shall be run at mixing speed for one full minute to insure an even mixture. The mixture shall be deposited in the trench directly from the mixer truck. Copies of the load tickets shall be provided to the Engineer.

B. After Settlement. Should after settlement occur, succeeding any of the above backfilling methods, the Contractor shall scarify the surface of the fill material and place additional fill material in the same manner as herein described so that the surface elevation conforms to that shown on the Plans. No additional compensation shall be allowed for repairing filled areas where after-settlement occurs.

C. Backfill Placement. The excavated space around and above underground structures, tunnels, conduits and pipes not filled with embedment material and where select fill backfill is not shown or specified may be backfilled by machine.

D. Backfilling work shall be done in such a way as to prevent dropping of material directly on top of any conduit or pipe through any great vertical distance. In no case shall backfilling material from a bucket be allowed to fall directly on a structure or pipe and in all cases, the bucket shall be lowered so that the shock of falling earth will not cause damage.

E. Lumps shall be broken up and if there are any stones, pieces of crushed rock or lumps, which cannot be readily broken up, they shall be distributed throughout the mass so that all interstices are solidly filled with fine material. Stones, lumps and clods shall also be placed to maintain a 2 foot minimum separation distance from the top of the pipe or structure. No frozen material shall be used for backfilling.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Trenching and Backfilling for utilities shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 TRENCHING AND BACKFILLING

A. Trenching and Backfilling, Inclusive. When no quantity is provided, trenching and backfilling shall be included in the payment for contract work related to the associated utility.

4.03 IMPORTED GRANULAR BACKFILL (TRUCKED BACKFILL)

A. Imported Granular Backfill (Trucked Backfill), Inclusive. When no quantity is provided, imported granular backfill (trucked backfill) shall be included in the payment for contract work related to the associated utility.

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SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Natural Resources (WDNR), Conservation Practice Standards, Current Edition.
   2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover providing the necessary materials, equipment and labor to control erosion and sedimentation controls by the methods specified herein. If no specific quantities are shown on the contract drawings, the Contractor shall use whatever quantities are necessary to prevent sediment transport off the job site, into permanent manmade storm water conveyances or management facilities or to Waters of the State.

B. The Contractor will be required to provide erosion control as per the current edition of the applicable State of Wisconsin, Department of Natural Resources (WDNR), Conservation Practice Standards. Copies of these standards can be obtained by contacting the following:

State of Wisconsin Department of Natural Resources
Non-Point Source and Land Management Section
101 South Webster Street, P.O. Box 7921
Madison, WI 53707-7921

or by visiting the following website:
http://dnr.wi.gov/topic/stormwater/standards/const_standards.html

C. The Engineer has prepared an erosion control plan for this project. The intent of this plan is to identify erosion control provisions for the construction site that comply with local, state, and federal regulations. The Contractor shall submit for approval by the appropriate regulatory agency any changes to the Erosion Control Plan, prior to beginning any construction on the project which may cause erosion in the portion of the site where the change to the Erosion Control Plan is proposed.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Clearing and Grubbing - Division 31

C. Grading - Division 31

D. Subgrade Preparation - Division 31

E. Structural Excavation for Structures - Division 31

F. Trenching and Backfilling - Division 31

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G. Riprap - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and free of roots, stumps, stones larger than 2 inches in any dimension, and other matter harmful to plant growth. Topsoil to supplement insufficient topsoil on the site shall originate from local sources, but not from bogs or marshes.

2.02 LIME

A. Lime used for soil amendment shall be agricultural grade limestone ground sufficiently fine so that 80 percent passes a No. 8 sieve. Lime shall contain 80 percent calcium carbonate equivalent. Moisture shall not exceed 10 percent.

2.03 FERTILIZER

A. Fertilizer used in conjunction with seeding shall be dry, free-flowing granular fertilizer suitable for application by agricultural fertilizer spreaders or blower equipment, or non-volatile liquid commercial fertilizer, having an analysis of 20-10-10 (Nitrogen-Phosphoric Acid-Potash), or equal, unless use of phosphorus based fertilizers are banned by the community where the work is to be completed. In such communities, an analysis of 20-0-10, or equal, shall be used. Fertilizer having other analysis shall be applied at a rate to achieve at least the individual following amounts of nutrient per unit area:

Nutrient	Application Rate (Per Acre)	Application Rate (Per 1000 Sq. Ft.)
Nitrogen (N)	100 pounds	2.3 pounds
Phosphoric Acid (P_2O_5)	50 pounds	1.2 pounds
Potash (K_2O)	50 pounds	1.2 pounds

2.04 SEEDING FOR CONSTRUCTION SITE EROSION CONTROL

A. Seeding for Construction Sites shall conform with Wisconsin DNR Conservation Practice Standard 1059.

B. Seed mixtures shall conform to one of the following:
1. WisDOT, 2003. State of Wisconsin Standard Specifications For Highway and Structure Construction. Section 630, Seeding.
2. United States Department of Agriculture – Natural Resource Conservation Service Field Office Technical Guide Section IV, Standard 342, Critical Area Planting.
3. UWEX Publication A3434 Lawn and Establishment & Renovation.

C. All seed shall conform to the requirements of the Wisconsin Statutes and of the Administrative Code Chapter ATCP 20.01 regarding noxious weed seed content and labeling.

D. Seed mixtures that contain potentially invasive species or species that may be harmful to native plant communities shall be avoided.

E. Seed shall not be used later than one year after the test date that appears on the label.

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F. Seed shall be tested for purity, germination and noxious weed seed content and shall meet the minimum purity and germination requirements as prescribed in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

2.05 MULCH FOR CONSTRUCTION SITES

A. Mulching for construction sites shall conform with Wisconsin DNR Conservation Practice Standard 1058.

B. Mulch shall consist of natural biodegradable material such as plant residue (including but not limited to straw, hay, wood chips, bark and wood cellulose fiber), or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period.

C. Mulch shall be environmentally harmless to wildlife and plants. Materials such as gravel, plastic, fabric, sawdust, municipal solid waste, solid waste byproducts1, shredded paper, and non-biodegradable products shall not be used.

D. Mulch shall be free of diseased plant residue (i.e., oak wilt), noxious weed seeds, harmful chemical residues, heavy metals, hydrocarbons and other known environmental toxicants.

E. Marsh hay shall not be used as mulch in lowland areas but may be used on upland sites to prevent the spread of invasive, nonnative species (i.e., reed canary grass) commonly found in marsh hay.

F. Straw and hay mulch that will be crimped shall have a minimum fiber length of 6 inches.

G. Wood chips or wood bark shall only be used for sites that are not seeded.

2.06 EROSION MAT

A. Non-Channel Erosion Mat products shall conform with Wisconsin DNR Conservation Practice Standard 1052.

B. Channel Erosion Mat products shall conform with Wisconsin DNR Conservation Practice Standard 1053.

C. Erosion mat shall conform to the requirements of the State of Wisconsin, Department of Transportation, Product Acceptability List (PAL) for Erosion Control Revegetative Mat (ECRM) and Turf-Reinforcement Mat (TRM).

D. For mats that utilize netting, the netting shall be bonded to the parent material to prevent separation of the net for the life of the product.

E. For urban class mats the following material requirements shall be adhered to:
   1. Only 100% organic biodegradable netted products are allowed, including parent material, stitching, and netting.
   2. The netting shall be stitched with biodegradable thread/yarn to prevent separation of the net from parent material.
   3. All materials and additive components used to manufacture the anchoring devices shall be completely biodegradable as determined by ASTM D 5338.
   4. Mats with photodegradable netting shall not be installed after September 1st.
   5. Steel wire pins or staples shall not be used in lawns.

2.07 SEEDING AND SODDING

A. Seeding and sodding shall conform to Seeding - Division 32 and Sodding - Division 32.

2.08 SEDIMENT CONTROL FENCE (SILT FENCE)

A. Silt Fence shall conform with Wisconsin DNR Conservation Practice Standard 1056.

B. Silt fence shall be in accordance with Section 628.2.6 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction.

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C. Wood Posts:
   1. Wood Posts used to support the fabric shall be at least 2 inch x 2 inch in cross-section and shall be a minimum of 12 inches longer than the height of the silt fence. Posts shall be made from kiln-dried hickory or Oak.
   2. Staples used to attach silt fence to wood posts shall be at least 0.5-inches in length.

D. Steel Supports:
   1. Steel posts shall be at least 5 feet long with a strength of 1.33 pounds per foot and shall have projections for the attachment of fasteners.
   2. The silt fence fabric shall be attached in at least three places on the upslope side with 50 pound plastic tie straps or wire fasteners.

E. Silt fence shall have a support cord.

F. The Contractor shall furnish upon request a manufacturer's Certificate of Compliance that the geotextile fabric as furnished meets the above requirements.

G. Silt Fence shall be installed in accordance with Wisconsin DNR Conservation Practice Standard 1056.

2.09 RIPRAP

A. Riprap shall be established in accordance with Riprap - Division 31 of this specification.

2.10 STONE TRACKING PAD

A. Stone Tracking Pads shall be established in accordance with Wisconsin DNR Conservation Practice Standard 1057.

B. The aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All material to be retained on a 3-inch sieve.

2.11 DUST CONTROL

A. Dust Control measures shall be implemented in accordance with Wisconsin DNR Conservation Practice Standard 1068.

B. Asphalt and petroleum based products shall not be used for dust control.

C. Mulch or seed and mulch may be applied to protect exposed soil from wind erosion according to the provisions of WDNR Conservation Practice Standard 1058 Mulching for Construction Sites and 1059 Seeding for Construction Site Erosion Control.

D. Polymers may be used for dust control according to the provisions of WDNR Conservation Practice Standard 1050 Erosion Control Land Application of Polymers.

E. Tackifiers and Soil Stabilizers Type A – Products must be selected from the WisDOT Erosion Control PAL.

F. Solid board fences, snow fences, burlap fences, crate walls, bales of hay and similar material may be used to control air currents and blown soil.

2.12 CONSTRUCTION SITE DE-WATERING

A. Construction Site Dewatering activities shall be conducted in accordance with Wisconsin DNR Conservation Practice Standard 1061.

2.13 STORM DRAIN INLET PROTECTION

A. Storm Drain Inlet Protection shall conform Wisconsin DNR Conservation Practice Standard 1060.

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B. All fabrics used as part of an inlet protection device must be selected from the list of approved fabrics certified for inlet protection, Geotextile Fabric, Type FF in the current edition of the WisDOT Product Acceptability List (PAL).

C. Inlet Protection Barriers include, but are not limited to, straw bales, sandbags, other material filled bags and socks, and stone weepers.

D. Manufactured bags, when used, shall conform to the standards below:
   1. Minimum Size 14 x 26 inches
   2. Grab Tensile strength of fabric, ASTM D-4632 = 95 lb. min.
   3. UV stability, ASTM D-4355 = 70 % min.
   4. Fabric shall be sewn together with double stitching.

E. Straw Bale installation shall conform to the criteria outlined in the WDNR Conservation Practice Standard (1055) Sediment Bale Barrier (Non-Channel).

F. Stone weeper installation shall conform to the criteria in WDNR Conservation Practice Standard (1063) Sediment Trap.

PART 3 EXECUTION

3.01 EROSION CONTROL REQUIREMENTS

A. The erosion control requirements specified in the project Storm Water Management Plan shall be adhered to at all times.

B. Temporary and permanent erosion control measures shall be performed by the Contractor. The Contractor shall control water pollution, erosion, and siltation through the use of intercepting embankments, berms, dikes, dams, settling basins, slope paving, ditch checks, riprap, mulches, erosion mats, seeding, sodding, plantings and other erosion control devices or methods.

C. The Contractor shall submit for approval his plan of operations for accomplishing temporary and permanent erosion control work relating to grubbing, grading, paving and other work which might create erosion.

D. The area of erosive land exposed to the elements by grubbing, excavation, borrow and fill operations at any one time shall be minimized to the maximum extent practicable and the duration of such exposure prior to final trimming, finishing and seeding or application of temporary erosion control measures shall be as short as practicable. Construction in and adjacent to rivers, streams, lakes, or other waterways shall be performed in such a manner as to avoid washing, sloughing or deposition of materials into such waterways which would obstruct or impair the flow thereof thus endangering the roadway or stream banks, or which would result in undue or avoidable contamination, pollution or siltation of such waterways.

E. The Owner or Designated Representative shall have full authority to suspend or limit grading and other operations pending adequate performance of such permanent erosion control measures as finish grading, topsoiling, mulching, matting and seeding and any temporary erosion control measures ordered by the Engineer.

F. Grubbing and grading operations shall be performed in proper sequence with other work to minimize erosion. Intercepting ditches or dikes shall be constructed as soon as practical after clearing and grubbing operations are completed and prior to or during the operations of excavating the cuts. Where erosion is likely to be a problem, the permanent erosion control measures shall follow immediately after the grading operations if conditions permit, unless the Engineer shall authorize temporary erosion control measures.

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G. Water pumped from the site shall be treated by temporary sedimentations basins, grit chambers, sand filters, upslope chambers, hydro-cyclones, swirl concentrators, or other appropriate controls designed and used to remove total suspended solids (TSS) to 40 mg/l or less for the highest dewatering pumping rate. If the water is demonstrated to contain less than 40 mg/l TSS during dewatering operations, then no control is needed before discharge. Water may not be discharged in a manner that causes erosion of the site or receiving channels. Construction Site Dewatering activities shall be conducted in accordance with Wisconsin DNR Conservation Practice Standard 1061.

H. The Contractor shall take all possible precautions to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday.

I. All storm drain or culvert inlets shall be protected with appropriate erosion control practices as identified in the appropriate Conservation Practice Standard. Channelized runoff from adjacent areas passing through the site shall be diverted around disturbed areas, if practical. Otherwise, the channel shall be protected. Sheet flow runoff from adjacent areas greater than 10,000 square feet in area shall also be diverted around disturbed areas unless shown to have resultant runoff velocities of less than 0.5 ft/sec across the disturbed area for one-year design storms having a duration of from 0.5 to 24 hours. Diverted runoff shall be conveyed in a manner that will not erode the conveyance and receiving channels.

J. All disturbed ground left inactive for seven (7) or more days shall be stabilized by seeding or sodding (only prior to October 15) or by mulching or covering, or other equivalent control measure.

K. For sites with more than 10 acres disturbed at one time, or if a channel originates in the disturbed area, one or more Temporary Sediment Traps shall be constructed in accordance with Wisconsin DNR Conservation Practice Standard 1063. The basin discharge rate shall also be sufficiently low as to not cause erosion along the discharge channel or the receiving water.

L. For sites with less than 10 acres disturbed at one time, sediment control fences, hay bales, or equivalent control measures shall be placed along all sideslope and downslope sides of the site. If a channel or area of concentrated runoff passes through the site, sediment control fences shall be placed along the channel edges to reduce sediment reaching the channel.

M. Any soil or dirt storage piles containing more than ten cubic yards of material should not be located with a downslope drainage length of less than 25 feet to a roadway or drainage channel. If remaining for more than seven (7) days, they shall be stabilized by mulching, vegetative cover, tarps, or other means. Erosion from piles which will be in existence for less than seven (7) days shall be controlled by placing hay bales or sediment control fence barriers around the pile. In-street utility repair or construction soil; or dirt storage piles located closer than 25 feet to a roadway or drainage channel must be covered with tarps or a suitable alternative control must be used if exposed for more than seven (7) days, and storm drain or culvert inlets must be protected with straw bales or other appropriate filtering barriers (CPS 1060).

3.02 TEMPORARY SEEDING

A. Seeding for Construction Sites shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1059.

B. Temporary Seeding (Cover Crop) - Areas needing protection during periods when permanent seeding is not applied shall be seeded with annual species for temporary protection. See table below for seeding rates of commonly used species. The residue from this crop may either be incorporated into the soil during seedbed preparation at the next permanent seeding period or left on the soil surface and the planting made as a no-till seeding.

Species	Lbs/Acre	Percent Purity
Oats	131[1]	98
Cereal Rye	131[2]	97
Winter wheat	131[2]	95
Annual Ryegrass	80[2]	97

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1 Spring and summer seeding

2 Fall seeding

C. Permanent Seeding - Rates shall be based on pounds or ounces of Pure Live Seed (PLS) per acre. If a nurse crop is used in conjunction with permanent seeding, the nurse crop shall not hinder establishment of the permanent vegetation. A nurse crop shall be applied at 50% its temporary seeding rate when applied with permanent seed.

D. Inoculation - Legume seed shall be inoculated in accordance with the manufacturer's recommendations. Inoculants shall not be mixed with liquid fertilizer.

E. Sowing
1. Seed grasses and legumes no more than 1/4 inch deep. Distribute seed uniformly. Mixtures with low seeding rates require special care in sowing to achieve proper seed distribution.
2. Seed may be broadcast, drilled, or hydroseeded as appropriate for the site.
3. Seed when soil temperatures remain consistently above 53°F. Dormant seed when the soil temperature is consistently below 53°F (typically November 1st until snow cover). Seed shall not be applied on top of snow.

F. Turf seedlings must not be mowed until the stand is at least 6 inches tall. Do not mow closer than 3 inches during the first year of establishment.

G. Alternate plans must be submitted for approval.

3.03 APPLICATION OF STRAW OR HAY MULCH

A. Mulching for Construction Sites shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1058.

B. Application Rate:
1. Mulch shall cover a minimum of 80% of the soil surface for unseeded areas. For seeded areas, mulch shall be placed loose and open enough to allow some sunlight to penetrate and air to circulate but still cover a minimum of 70% of the soil surface.
2. Mulch shall be applied at a uniform rate of 1½ to 2 tons per acre for sites that are seeded, and 2 to 3 tons per acre for sites that are not seeded. This application results in a layer of ½ to 1½ inches thick for seeded sites, and 1½ to 3 inches thick for sites not seeded.
3. Wood chips or wood bark shall be applied at a rate of 6 to 9 tons per acre to achieve a minimum of 80% ground cover. This application should result in a layer of wood chips or wood bark ½ to 1½ inches thick.

C. In areas where mulch is to be placed over seed, mulch shall be placed within 24 hours of seeding.

D. Mulch Anchoring Methods - Anchoring of mulch shall be based on the type of mulch applied, site conditions, and accomplished by one of the following techniques:
1. Crimping: Immediately after spreading, the mulch shall be anchored by a mulch crimper or equivalent device consisting of a series of dull flat discs with notched edges spaced approximately 8 inches apart. The mulch shall be impressed in the soil to a depth of 1 to 3 inches.
2. Polypropylene Plastic, or Biodegradable Netting: Apply plastic netting over mulch application and staple according to manufacturer's recommendations.
3. Tackifier: Tackifier shall be sprayed in conjunction with mulch or immediately after the mulch has been placed. Tackifiers must be selected from those that meet the WisDOT Erosion Control Product Acceptability List (PAL). Asphalt based products shall not be applied.
    a. The tackifiers shall be applied at the following minimum application rates per acre:
        1) Latex-Base: mix 15 gallons of adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 375 gallons of water.

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2) Guar Gum: mix 50 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as tracer with 1,300 gallons of water.

3) Other Tackifiers: (Hydrophilic Polymers) mix 100 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.

3.04 PLACING EROSION MAT

A. Installation instructions shall be supplied by the manufacturer. The Contractor shall install the mat in accordance with the manufacturer's recommendations and in accordance with Section 628.2 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, and the State of Wisconsin, Department of Transportation general requirements for erosion mat except as may be modified herein.

B. Erosion control revegetative mats shall be installed after all topsoiling, fertilizing, liming and seeding is complete.

C. The mat shall be in firm and intimate contact with the soil. It shall be installed and anchored per the manufacturer's recommendation.

D. The mat shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, mat shall be unrolled and applied parallel to the direction of drainage. On slopes, mat shall be applied parallel to the slope direction.

E. Turf-reinforcement mat shall be installed in conjunction with the topsoiling operation and shall be followed by Erosion Control Revegetative Mat installation.

F. At time of installation, document the manufacturer and mat type by retention of material labels and manufacturer's installation instructions. Retain this documentation until the site has been stabilized.

G. In channels and on slopes, each upslope and each downslope end of each piece of mat shall be placed in a 4-inch trench, stapled on 12-inch centers, backfilled and tamped. Where one roll ends and second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12 inch overlap, placed in a 4 inch trench, stapled on 12 inch centers, backfilled and tamped. In channels, erosion mats shall extend for whichever is greater: upslope one-foot minimum vertically from the ditch bottom or 6 inches higher than the design flow depth.

H. On slopes, where two or more widths of mat are applied, the two edges shall be overlapped according to the manufacturer's installation instructions and stapled at 18 to 24 inch intervals along the exposed edge of the lap joint. The body of the mat shall be stapled in a grid pattern with staples 3 feet on center each way.

I. Where heavy concentrations of water or extremely erodible soil conditions exist, as noted on the contract drawings, erosion checks shall be installed at intervals of 50 feet, or less. Such a check shall consist of a 4-inch deep trench perpendicular to the flow direction across the entire width of the fabric. The mat shall be stapled at 9-inch intervals along the bottom of the trench across the entire width of the mat. The trench shall then be backfilled and tamped.

J. If anchoring devices become loosened, or if any fabric loosens, is torn or undermined, repairs shall be made immediately without additional compensation.

K. Erosion mat when used in conjunction with fertilizing and seeding done for surface restoration, shall be installed immediately after fertilizing and seeding operations have been completed. Straw or hay mulch shall not be used under the fabric.

L. Erosion mat shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

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1. If there are signs of rilling under the mat, install more staples or more frequent anchoring trenches. If rilling becomes severe enough to prevent establishment of vegetation, remove the section of mat where the damage has occurred. Fill the eroded area with topsoil, compact, reseed and replace the section of mat, trenching and overlapping ends per manufacturer's recommendations. Additional staking shall be provided where rilling was filled.
2. If the reinforcing plastic netting has separated from the mat, remove the plastic and if necessary replace the mat.
3. Maintenance shall be completed as soon as possible with consideration to site conditions.

3.05 CONSTRUCTION OF SEDIMENT CONTROL FENCE (SILT FENCE)

A. Silt Fence shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1056.

B. When installed as a stand-alone practice on a slope, silt fence shall be placed on the contour. The parallel spacing shall not exceed the maximum slope lengths for the appropriate slope as specified:

Slope	Fence Spacing
< 2%	100 feet
2 to 5%	75 feet
5 to 10%	50 feet
10 to 33%	25 feet
> 33%	20 feet
> 50%	Not Permitted

C. Silt fences shall not be placed perpendicular to the contour.

D. The ends of the fence shall be extended upslope to prevent water from flowing around the ends of the fence.

E. When attached to wooden posts the silt fence fabric shall be stapled, using at least 0.5-inch staples, to the upslope side of the posts in at least 3 places.

F. When attached to steel supports the silt fence fabric shall be attached in at least three places on the upslope side with 50 pound plastic tie straps or wire fasteners. To prevent damage to the fabric from fastener, the protruding ends shall be pointed away from the fabric.

G. The maximum spacing of posts for nonwoven silt fence shall be 3 feet and for woven fabric 8 feet.

H. Where joints are necessary, each end of the fabric shall be securely fastened to a post. The posts shall then be wrapped around each other to produce a stable, secure joint or shall be overlapped the distance between two posts.

I. On the terminal ends of silt fence the fabric shall be wrapped around the post such that the staples are not visible.

J. A minimum of 20 inches of the post shall extend into the ground after installation.

K. Anchoring – Silt fence shall be anchored by spreading at least 8 inches of the fabric in a 4 inch wide by 6 inch deep trench, or 6 inch deep V-trench on the upslope side of the fence. The trench shall be backfilled and compacted. Trenches shall not be excavated wider and deeper than necessary for proper installation.

L. Removal – Silt fences shall be removed once the disturbed area is permanently stabilized and no longer susceptible to erosion.

M. Silt fences shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.

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N. Damaged or decomposed fences, undercutting, or flow channels around the end of barriers shall be repaired or corrected.

O. Sediment shall be properly disposed of once the deposits reach 1/2 the height of the fence.

3.06 STONE TRACKING PAD

A. Stone Tracking Pads shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1057.

B. The tracking pad shall be installed prior to any traffic leaving the site.

C. The aggregate shall be placed in a layer at least 12 inches thick. On sites with a high water table, or where saturated conditions are expected during the life of the practice, stone tracking pads shall be underlain with a WisDOT Type R geotextile fabric to prevent migration of underlying soil into the stone.

D. Tracking pads and tire washing stations shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

E. The tracking pad performance shall be maintained by scraping or top-dressing with additional aggregate.

F. A minimum 12-inch thick pad shall be maintained.

3.07 STORM DRAIN INLET PROTECTION

A. Storm Drain Inlet Protection shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1060.

B. The contributing drainage area to the inlet protection device shall be one acre or less. In instances were a larger contributing drainage area exists, runoff shall be routed through a properly designed sediment trapping or settling device upstream of inlet.

C. Other than Type D inlet protection devices, no gaps shall be left in the material used that would allow the flow of water to bypass the inlet protection device.

D. Filter Fabric Barrier Criteria - See Inlet Protection Detail
   1. Inlet protection Type A devices shall be utilized around inlets and unpaved areas until permanent stabilization methods have been established. Type A devices shall be utilized on inlets prior to installation of curb and gutter or pavement, and where safety considerations are not compromised on the site.
   2. Type B shall be utilized after the casting and grate are in place.
   3. Type D shall be utilized in areas where other types of inlet protection are identified as incompatible with roadway and traffic conditions, causing possible safety hazards when ponding occurs at the inlet. Type D shall only be used after castings are in place on top of the inlet boxes.
   4. Type D inlet protection shall conform to the standard drawing as shown in the contract drawings. There shall be a three-inch space between the bag and the sides of the inlet to prevent the inlet sides from blocking the overflow; and shall only be used in inlets deeper than 30 inches from the top of grate to bottom of the inlet. If such clearance is not available, cinch or tie the sides of the bag (with rope or ties) to provide clearance.

E. Criteria Applicable to the Post-Paving/Curbing Phase of Construction
   1. Inlet protection Types B, C, and D are applicable to post paving construction. See Inlet Protection Detail.
      a. Type B shall be utilized on inlets without curb box.
      b. Type C shall be utilized on street inlets with curb heads. A 1½ inch x 3½ inch (37 mm by 87 mm) minimum, piece of wood shall be wrapped and secured in the fabric and placed in front of the curb head as shown in the contract drawings. The wood shall not block the entire opening of the curb box and be secured to the grate with wire or plastic ties.

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c. Type D.

F. Remove inlet protection devices once the contributing drainage area is stabilized with appropriate vegetation or impervious area.

G. Inlet protection shall be at a minimum inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

H. Sediment deposits shall be removed and the inlet protection device restored to its original dimensions when the sediment has accumulated between 1/3 to 1/2 the design depth of the device, or when the device is no longer functioning as designed. Removed sediment shall be deposited in a suitable area and stabilized.

I. Any material falling into the inlet shall be removed.

3.08 DUST CONTROL

A. Dust Control measures shall be installed and maintained in accordance with Wisconsin DNR Conservation Practice Standard 1068.

B. Polymers may be used in areas that do not receive vehicle traffic. Dry applied polymers must be initially watered for activation to be effective for dust control. Polymers shall be utilized in accordance with the provisions of WDNR Conservation Practice Standard 1050 Erosion Control Land Application of Polymers.

C. Tackifiers and Soil Stabilizers Type A – Products must be installed at rates conforming to the WisDOT Erosion Control PAL.

D. Chlorides shall be applied according to the most recent version of the WisDOT Standard Specifications for Highway and Bridge Construction.

E. Barriers - Barriers shall be placed at right angles to prevailing wind currents at intervals of about 15 times the barrier height.

F. Areas that have dust control practices shall at a minimum be inspected daily.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Erosion and sedimentation controls shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 EROSION AND SEDIMENTATION CONTROLS

A. Erosion and Sedimentation Controls, Lump Sum. When so provided, payment for erosion and sedimentation controls shall be made at the contract lump sum price bid.

B. Erosion and Sedimentation Controls, Inclusive. When no quantity is provided, erosion and sedimentation controls shall be considered inclusive to payment for contract work related to the associated construction.

END OF SECTION

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SECTION 31 37 00
RIPRAP

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the riprapping for this project and in accordance with the provisions of Section 606 of the Standard Specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Geosynthetics for Earthwork - Division 31

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 MATERIALS

A. Provide riprap stone grade (i.e., light riprap, medium riprap, heavy riprap, extra-heavy riprap) as indicated in the Special Procedures - Division 01 or as shown on the contract drawings, and in conformance with Section 606 of the Standard Specifications. Stone shall be durable field or quarry stone approved by the Engineer prior to placing. It shall be sound, hard, dense, resistant to the action of air and water, and free from seams, cracks or other structural defects.

PART 3 EXECUTION

A. The bed for the riprap shall be prepared by excavating, shaping the slopes and constructing the toe for riprap installation. Restore the surface of adjacent work following riprap placement, and dispose of surplus material.

3.02 PLACING LIGHT RIPRAP

A. Stone placed above the waterline shall be placed by hand. It shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with ends in contact. The stone shall be thoroughly compacted as construction progresses and the finished surface shall present an even, tight surface. The larger stone shall be placed in the lower courses. Interstices between stones shall be chinked with spalls firmly rammed into place. Unless otherwise provided, light riprap shall be at least 12 inches in thickness, measured perpendicular to the slope. Use Type R geotextile fabric under stone. Stone shall not be placed against or in contact with any concrete surface prior to the completion of the concrete's curing and protection period

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3.03 PLACING MEDIUM, HEAVY AND EXTRA-HEAVY RIPRAP

A. Stone may be placed by any mechanical means that will produce a completed job within reasonable tolerances of the typical section shown on the contract drawings. Unless otherwise provided on the contract drawings, medium ripap shall not be less than 18 inches in thickness, heavy riprap shall be not less than 24 inches in thickness and extra-heavy riprap shall not be less than 30 inches in thickness, all measured perpendicular to the slope. Hand work shall be limited to the amount necessary to fill large voids or to correct segregated areas. Use Type HR geotextile fabric under stone. Stone shall not be placed against or in contact with any concrete surface prior to the completion of the concrete's curing and protection period.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Riprap shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 RIPRAP

A. Riprap (Grade), Cubic Yard. Riprap will be measured by the cubic yard acceptably completed, measured as the volume within the limiting dimensions the contract designates, or the engineer establishes in the field. Payment for riprap is full compensation for preparing the bed, providing and placing riprap, restoring adjacent work, and disposing of surplus material.

END OF SECTION

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SECTION 32 11 23
AGGREGATE BASE AND SUBBASE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material equipment and labor required to construct a dense compacted base course composed of one or more courses or layers of coarse aggregate, fine aggregate and binder or filler blended to produce an intimate mixture of the required gradation and stability, in accordance with Sections 301 and 305 of the State of Wisconsin, Department of Transportation, Standard Specifications. This work shall also consist of a furnishing all material equipment and labor required to place breaker run and select crushed material for this project in accordance with Sections 301, 311 and 312 of the State of Wisconsin, Department of Transportation, Standard Specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Subgrade Preparation - Division 31

C. Salvage Existing Pavement and Base - Division 32

1.05 SUBMITTALS (NONE)

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 DENSE GRADED BASE

A. Materials furnished and used in this work shall consist of coarse and fine aggregate with sufficient binder to produce a stable base for the surfacing. Base materials shall be free from vegetative or organic matter, shale and lumps of clay. Dense graded base shall be crushed stone or crushed gravel conforming to the gradations required in Section 305.2.2.1 of the State of Wisconsin, Department of Transportation, Standard Specifications, unless indicated otherwise in Special Procedures - Division 01 or on the contract drawings.

PART 3 EXECUTION

3.01 DENSE GRADED BASE

A. Each layer of base shall be compacted over the entire area per Section 301.3 and 305.3 of the State of Wisconsin, Department of Transportation, Standard Specifications.

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B. Each layer shall also be compacted and consolidated to the degree that there will be no appreciable displacement of it laterally or longitudinally under compaction equipment or a fully loaded tandem dump truck.

C. Where aggregate base is being placed on top of existing gravel, the existing gravel shall be scarified to a depth of three inches prior to placement of additional base.

D. Aggregate base course beneath and within 10 feet of a structure shall be compacted to 95 percent maximum dry density per modified proctor (ASTM D1557).

E. The aggregate base shall be graded, shaped and rolled to the finished cross section template shown on the contract drawings and to the satisfaction of the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Aggregate base course shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 DENSE GRADED BASE

A. Dense Graded Base, Square Yard. Measurement for dense graded base will be per square yard installed as measured in the field. The dense graded base shall be installed and compacted to the thickness stated on the contract drawings or in Special Procedures - Division 01. Payment shall be made at the contract unit price bid per square yard for dense graded base installed and compacted.

B. Dense Graded Base, Ton. Measurement will be per ton of dense graded base compacted in place. The Contractor shall supply the Engineer with load tickets to verify the amount of material used. Each load shall have its own load ticket showing weights, truck number, time, date, and placement location. Payment shall be made at the contract unit price bid per ton for dense graded base installed and compacted.

C. Dense Graded Base, Cubic Yard In Place. Measurement for dense graded base will be per cubic yard installed, computed from the square yards measured in the field multiplied by the compacted thickness stated on the contract drawings or in the Special Procedures – Division 01. Payment will be made at the contract unit price bid per cubic yard in place for dense graded base installed.

END OF SECTION

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SECTION 32 12 13.16
ASPHALTIC TACK COAT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section includes all materials, equipment, supervision, and labor necessary to apply asphaltic tack coat prior to paving asphaltic concrete pavement on an existing surface, as indicated on the Contract Drawings.

B. All work shall conform to the requirements specified in Section 455 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Asphaltic Concrete Pavement - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 ASPHALTIC TACK COAT

A. The materials furnished and used for asphaltic tack coat shall conform to the requirements of Section 455 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition.

PART 3 EXECUTION

3.01 GENERAL

A. All work shall conform to the requirements specified in Section 455 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition, unless specified otherwise herein or in Special Procedures - Division 01.

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B. Apply asphaltic tack coat only when the air temperature is 32°F or more, unless the engineer approves otherwise in writing. Do not apply to surfaces with standing water, and do not apply if weather or surface conditions are unfavorable, or before impending rains.

C. Apply the asphaltic tack coat at 0.050 to 0.070 gallons per square yard or as otherwise designated by the Engineer to provide complete and uniform coverage.

D. Apply asphaltic tack coat to the vertical faces of adjacent curbs and pavement, as well as to the lower asphalt layer, unless the upper asphalt layer is installed the same day as the lower asphalt layer. Also apply asphaltic tack coat to existing pavement surfaces to be overlaid.

3.02 PREPARING THE EXISTING SURFACE

A. Immediately prior to applying the asphaltic tack coat to existing surfaces, remove all vegetation from the surface and sweep the surface to remove all dust, dirt, debris or other foreign or loose material.

3.03 MAINTAINING TACK COAT

A. Protect and repair the existing surface and the tack coat. Correct areas with excess or deficient tack material and any breaks, raveled spots, or other areas where bond might be affected.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Asphaltic tack coat shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

C. Payment for Asphaltic Tack Coat is full compensation for providing tack coat; for preparing the surface; and for maintaining the completed work.

4.02 ASPHALTIC TACK COAT

A. Asphaltic Tack Coat, Inclusive. When no quantity is provided, asphaltic tack coat shall be considered inclusive to payment for asphaltic concrete pavement.

END OF SECTION

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SECTION 32 12 16
ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section includes all materials, equipment, supervision, and labor necessary to construct a plant-mixed asphaltic concrete pavement on the prepared foundation of base course or existing surface, as indicated on the contract drawings and specified herein.

B. All work shall conform to the requirements specified in the State of Wisconsin, Department of Transportation, Standard Specifications for the particular class, type and grade of material specified.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Subgrade Preparation - Division 31

D. Aggregate Base and Subbase - Division 32

E. Asphaltic Tack Coat - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

B. Job Mix Formula. Contractor shall submit a Wisconsin Department of Transportation approved Job Mix Formula for the asphaltic mixture to be used to the Engineer prior to paving. If requested, the Contractor shall submit a history of recent testing results.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 GENERAL

A. All materials shall conform to the requirements of the State of Wisconsin, Department of Transportation, Standard Specifications, unless specified otherwise herein or in Special Procedures - Division 01.

B. Asphaltic concrete pavement shall be Asphaltic Concrete Pavement, Classification LT, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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2.02 ASPHALTIC MATERIAL

A. The asphaltic material for asphaltic concrete pavement, including overlays shall be asphalt, Type AC with an Asphaltic Binder Grade of PG 58-28 and a binder designation 'S' unless specified otherwise in the Bid Schedule or Special Procedures – Division 01.

PART 3 EXECUTION

3.01 GENERAL

A. All work shall conform to the requirements specified in the State of Wisconsin, Department of Transportation, Standard Specifications for the particular class, type and grade of material specified, unless specified otherwise herein or in Special Procedures - Division 01.

3.02 PREPARATION

A. All existing asphaltic concrete pavement removals, including driveway removals, shall be saw cut to the limits designated as pavement removal on the contract drawings or to the limits staked by the Engineer in the field. Typically, all pavement sawcuts shall be parallel or perpendicular to the centerline of the roadway.

B. Weeds shall be removed on all streets to be resurfaced prior to the application of the tack coat or construction of asphaltic concrete pavement. Prior to the application of the tack coat or construction of asphaltic concrete, the surface of the prepared foundation shall be cleaned by brooming all dust, dirt, debris or other foreign or loose material.

C. Apply tack coat as specified in Asphaltic Tack Coat - Division 32 to existing pavement and each layer of a plant-mixed asphaltic base or pavement that will be overlaid with asphaltic mixture.

D. The Contractor shall perform all final shaping and grading of aggregate bases necessary to produce the required roadway cross sectional contour. All valve boxes, manhole frames, and other utility appurtenances shall be adjusted to the final grade prior to the placement of the upper layer of asphalt.

3.03 PLACEMENT

A. Asphaltic concrete pavements shall be placed in reasonable conformity with the thickness shown on the contract drawings, Bid Schedule, or specified in Special Procedures - Division 01.

B. Upper layer paving. The upper layer of asphalt pavement shall not be paved when ambient air temperatures 3-feet above the paving surface is less than 40 degrees F.

C. Lower layer paving. The lower layer of asphalt pavement shall not be paved when ambient air temperatures 3-feet above the paving surface is less than 32 degrees F.

D. The following thickness limits shall apply unless specified otherwise:

ASPHALT MIX GRADATION (Nmas)	NOMINAL AGGREGATE SIZE (inches)	MINIMUM LAYER THICKNESS (inches)	MAXIMUM LOWER LAYER (inches)	MAXIMUM UPPER LAYER (inches)
1	1.5	3.5	5	4.5
2	1.0	3.25	5	4
3	3/4	2.25	4	3
4	1/2	1.75	3	2.5
5	3/8	1.5	3	2

3.04 COMPACTION

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A. Compaction methods and requirements shall conform to Sections 450.3.2.6 and 460.3.3 of the State of Wisconsin, Department of Transportation, Standard Specifications.

B. The Contractor shall perform field pavement density tests on projects requiring over 1000 tons of asphaltic mixture. Tests shall be performed to determine the necessary compaction methods to achieve the required minimum density. The Contractor shall not operate below the specified minimum density on a continuing basis.

C. Additional tests shall be performed as directed by the Engineer for varying paving conditions, such as different weather conditions, base conditions, job mix, layer thickness, and construction methods.

D. Documentation of all testing shall be provided to the Engineer.

3.05 QUALITY CONTROL

A. The Contractor shall provide and maintain a quality control program.

B. If requested by the Owner or Engineer, submit samples and sampling data of all proposed materials for test and analysis.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Asphaltic concrete pavement shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 ASPHALTIC CONCRETE PAVEMENT

A. Asphaltic Concrete Pavement, Ton. Measurement shall be per ton of asphaltic binder course and surface course compacted in place. The Contractor shall supply the Engineer with load tickets to verify the amount of material used. Payment shall be made at the contract unit price bid per ton for asphaltic concrete pavement installed.

B. Asphaltic Concrete Pavement, Lump Sum. When so provided, payment for Asphaltic Concrete Pavement shall be made at the contract lump sum price bid.

END OF SECTION

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SECTION 32 13 10
CONCRETE SIDEWALK, STEPS AND DRIVEWAYS

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the concrete sidewalk, driveway and step work for this project.

B. This work shall be in accordance with Section 602 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as indicated on the contract drawings and specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Concrete Quality Control - Division 01

C. Maintenance of Existing Conditions - Division 02

D. Cast-in-Place Concrete - Division 03

E. Subgrade Preparation - Division 31

F. Aggregate Base and Subbase - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts to relate the materials supplied to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 CONCRETE

A. Concrete for sidewalk, steps and driveways shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

2.02 BASE MATERIAL

A. Base material shall be as specified in Aggregate Base and Subbase - Division 32 of these specifications or conform with Section 305 of the State of Wisconsin, Department of Transportation, Standard Specifications.

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2.03 CURING COMPOUND

A. Curing compound shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

PART 3 EXECUTION

3.01 BASE PREPARATION - GRADING

A. Prepare foundation by excavating to the lines, grades and cross section as required. All soft or unstable material shall be removed and replaced with sand or aggregate base course material compacted to a relative field density of 95%, based on the Modified Proctor Density, ASTM D1557. Proof-roll subbase to check for unstable areas needing additional compaction. Finish to a true and firm surface.

B. If not listed as a separate bid item, minor clearing and grubbing shall be considered incidental to the respective concrete work.

C. Disposal locations for all excess or unsuitable excavated material shall be subject to Owner approval.

3.02 BASE MATERIAL

A. A minimum thickness of 4 inches of compacted aggregate base course or granular subbase course material is required under sidewalks and steps, unless indicated otherwise on the contract drawings or Special Procedures - Division 01.

3.03 SIDEWALK

A. Sidewalks shall be constructed to a uniform depth of 4 inches except at alleys and driveways where they shall be constructed to a uniform depth of 6 inches unless otherwise noted.

B. Sidewalks shall slope toward the roadway at 1 foot vertical per 50 feet horizontal (2 percent).

C. The concrete shall be placed on a moist foundation, deposited to the required depth, and consolidated and spaded sufficiently to bring the mortar to the surface, after which it shall be struck off and finished to a true and even surface.

D. The final floating shall be done with a wooden float. Before the mortar has set, the surface shall be brushed or lightly broomed, perpendicular to the direction of travel or as shown on the contract drawings. Before the concrete is given the final surface finish, the surface of the walk shall be checked with a ten-foot straightedge, and any areas which show a variation or departure from the testing edge of more than 1/4 inch shall be corrected by adding or removing concrete as necessary while the concrete is still plastic.

E. Concrete sidewalks may be constructed with suitable, approved slip-form equipment when permitted by the Engineer. The wood floating may be omitted when a suitable finish is produced by the slip-form equipment.

F. Ramps for individuals with disabilities shall be constructed at the locations and in accordance with the details and dimensions shown on the contract drawings, these specifications and the Americans with Disabilities Act (ADA). Ramps shall include detectable warning fields installed per manufacturer's recommendations.

G. Where reinforcement is required, it shall conform to and be placed in accordance with the details shown on the contract drawings.

H. Joints for sidewalks, including transverse joints, longitudinal joints, contraction joints, expansion joints and joint felts and filler materials shall conform to the requirements of Section 602.3.2.5 of the State of Wisconsin, Department of Transportation, Standard Specifications, except as modified herein.

1. Sidewalks shall be divided into sections not less than 3 feet nor more than 12 feet, unless otherwise indicated on the contract drawings. Transverse joints shall be spaced at 6 foot intervals.
2. Prefabricated expansion joint of 1/2-inch thickness shall be placed where steps or sidewalks abut curbs, pavements, steps, or existing sidewalk. Prefabricated expansion joint of 1 inch thickness shall

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be placed where sidewalk abuts buildings, retaining walls, or other rigid structures. Expansion joints shall be provided on each side of driveways and at uniform intervals of not more than 96 foot centers for sidewalk construction.

3. Extend joint fillers full-width and depth of joint and not less than 1/4-inch or more than 1/2-inch below finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Trim top edge of filler to conform to profile of concrete.

3.04 DRIVEWAYS

A. Driveways shall be constructed to a uniform depth of 6 inches. Driveways shall be constructed to the limits and slope shown on the contract drawings or as staked by the Engineer.

3.05 CURING COMPOUND

A. Curing compound shall be applied at the recommended coverage requirement and application rate of the manufacturer. The compound shall be applied by sprayer as soon as all free water has disappeared after finishing operations.

B. If the coating is damaged within 72 hours of its application, the damaged surfaces shall be resprayed immediately.

3.06 ADJUSTING UTILITY APPURTENANCES

A. Valves and curb stop boxes shall be adjusted to finished grade of new construction in a manner that the new construction will not interfere with the proper operation of the facility. Catch basins, manholes and inlet covers shall be adjusted to the required elevation by adjusting the top of the existing structure by removing or adding adjusting rings and reinstalling the fixtures firmly in place.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Concrete sidewalk, steps and driveways shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SECTION 32 16 13
CONCRETE CURB AND GUTTER

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   2. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing all material, equipment, and labor required to execute the construction of concrete curb and gutter for this project.

B. This work shall be in accordance with Section 601 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as indicated on the contract drawings and these specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Cast-in-Place Concrete - Division 03

C. Subgrade Preparation - Division 31

D. Aggregate Base and Subbase - Division 32

E. Concrete Sidewalk, Steps, and Driveways - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 CONCRETE

A. Concrete for curb and gutter construction shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

2.02 BASE MATERIAL

A. Base material for concrete curb and gutter construction shall be as specified in Aggregate Base and Subbase - Division 32 of these specifications.

2.03 CURING COMPOUND

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A. Curing compound for curb and gutter construction shall be as specified in Cast-in-Place Concrete - Division 03 of these specifications.

PART 3 EXECUTION

3.01 CONCRETE CURB AND GUTTER, GENERAL

A. All work shall be in accordance with Section 601 of the State of Wisconsin, Department of Transportation, Standard Specifications, and as otherwise indicated on the contract drawings and as specified herein.

3.02 GRADING

A. Prepare foundation by excavating to the lines, grades and cross section as required.

B. All soft or unstable material shall be removed and replaced with sand, gravel or crushed stone base course material compacted to a relative density of 95 percent, of the Modified Proctor density, ASTM D1557. Proof-roll subbase to check for unstable areas needing additional compaction. Finish to a true and firm surface.

C. Dispose of all excess or unsuitable excavated material, subject to Engineer's approval.

3.03 BASE MATERIAL UNDER CURB AND GUTTER

A. A minimum of 4 inches of compacted aggregate base course material is required under the curb and gutter, unless otherwise indicated on the contract drawings or Special Procedures - Division 01.

3.04 CONCRETE CURB AND GUTTER

A. This work shall consist of constructing combination curb and gutter of the type shown on the contract drawings and to the line and grade as staked in the field.

B. Driveway entrances shall be installed where shown on the contract drawings or at any other locations required by the Engineer.

C. Final brooming shall be done perpendicular to the curb.

3.05 JOINTS

A. Construct expansion, weakened-plane (contraction), and construction joints with face perpendicular to surface, unless otherwise shown. Construct traverse joints at right angles to curb, unless otherwise shown on the contract drawings or specifically designated in Special Procedures - Division 01.
   1. Provide expansion joints on each side of catch basins, inlets, structures, and other fixed objects; abutting to existing curb and gutter; at radius points; and at 300 foot centers, unless otherwise shown.
   2. Contraction joints shall be a slot or groove at least 1 inch in depth by 1/4 inch width at 20-foot maximum and 6-foot minimum intervals.

B. Extend joint fillers full-width and depth of joint, and not less than 3/4 inch or more than 1 inch below finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Trim top edge of filler to conform to profile of concrete.

3.06 CURING COMPOUND

A. Curing compound shall be applied at the recommended coverage requirement and application rate of the manufacturer. The compound shall be applied by sprayer as soon as all free water has disappeared after finishing operations.

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B. If the coating is damaged within 72 hours of its application, the damaged surfaces shall be resprayed immediately.

3.07 ADJUSTING UTILITY APPURTENANCES

A. Adjust valve and curb stop boxes to finished grade of new construction in a manner that the new construction will not interfere with the proper operation of the facilities.

B. Adjust catch basin, manhole and inlet frames and covers to the required elevation by adjusting the top of the existing structure by removing or adding concrete masonry and reinstalling the fixtures, supporting them in a collar of concrete mortar and brick constructed to hold then firmly in place.

3.08 SAWCUTTING

A. The existing curb and gutter shall be sawcut full-depth, where the existing curb and gutter sections will butt to the new sections.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Concrete curb and gutter shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

END OF SECTION

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SECTION 32 91 19.13
TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing all material, equipment, and labor required to salvage and/or furnish, haul, place, and prepare topsoil for this project in accordance with Section 625 of the State of Wisconsin, Department of Transportation Standard Specifications.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Erosion and Sedimentation Controls - Division 31

C. Grading - Division 31

D. Subgrade Preparation - Division 31

E. Seeding - Division 32

1.05 SUBMITTALS

A. Submit a sample of the topsoil material prior to placement. Topsoil material shall be approved by the Owner or Engineer prior to placing on the project.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 TOPSOIL

A. Topsoil shall be screened and conform to Section 625 of the State of Wisconsin, Department of Transportation, Standard Specifications. A minimum of 100% of the topsoil shall pass through the one-inch sieve (25 mm) and 90% shall pass the No. 10 (2.00 mm) sieve.

B. Topsoil shall be shredded and conform to Section 625 of the State of Wisconsin, Department of Transportation, Standard Specifications. 100% of the topsoil shall pass through the one-inch sieve (25 mm).

2.02 SALVAGED TOPSOIL

A. Topsoil salvaged from the project site may be used to replace planned quantities of topsoil.

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B. Salvaged topsoil shall be screened and conform to Section 625 of the State of Wisconsin, Department of Transportation, Standard Specifications. A minimum of 100% of the topsoil shall pass through the one-inch sieve (25 mm) and 90% shall pass the No. 10 (2.00 mm) sieve.

C. Salvaged topsoil shall be shredded and conform to Section 625 of the State of Wisconsin, Department of Transportation, Standard Specifications. 100% of the topsoil shall pass through the one-inch sieve (25 mm).

PART 3 EXECUTION

3.01 PRESERVATION OF TREES AND SHRUBS

A. Trees and shrubs to be preserved shall be thoroughly protected from scarring or other injury during placement and grading operations. Excavation operations shall not disturb the original ground around trees within a distance of one foot or twice the diameter of the tree, whichever is greater. Exposed roots resulting from excavation shall be cut cleanly and covered with humus-bearing soil.

B. When necessary or required by the Contract Documents, trees or shrubs around which embankment is placed shall be protected by tree wells built in accordance with Detailed Drawings or as laid out in the field by the Owner or Engineer.

3.02 REMOVING AND SALVAGING TOPSOIL

A. General. Topsoil shall be stripped and salvaged or removed in accordance with Subsection 625.3 of the State of Wisconsin, Department of Transportation Standard Specifications.

B. Salvaged Topsoil. Topsoil shall be stripped to full depth, or a minimum depth of 6 inches (whichever is less), in all areas of cut or fill, except within proposed roadway limits topsoil shall be stripped full depth. Stockpile topsoil in storage piles in areas shown, or where otherwise directed. Construct storage piles to freely drain surface water. Cover or sprinkle water on storage piles if required to prevent windblown dust. Any appreciable volume left in the stockpile after properly placing shall become the property of the Owner and left in the pile. In any event, the pile shall be smoothed and seeded. All piles, which are to be left for seven or more days, shall be stabilized as indicated in the Erosion and Sedimentation Controls - Division 31.

3.03 PLACEMENT AND GRADING

A. General. Topsoil shall be placed in accordance with Subsection 625.3 of the State of Wisconsin, Department of Transportation Standard Specifications.

B. Grading. The Contractor shall grade in back of the curb or walk to provide a smooth surface and a 4:1 maximum slope unless shown otherwise on the plan. Graded surfaces shall be covered with topsoil to finished grade as shown on the typical sections.

C. Utility Adjustment. The Contractor shall adjust all valve boxes, manhole frames, and other utility appurtenances to within 1 inch of the final grade as shown on the contract drawings or as staked in the field by the Engineer.

D. All areas disturbed by the Contractor's activities and intended for seeding or sodding shall be topsoiled to the depth of 4-inches unless shown otherwise on the Contract Drawings or specified in Special Procedures - Division 01.

E. All areas disturbed by the Contractor's activities and intended for cultivation of vegetation other than turf shall be topsoiled to the depth of the original topsoil, unless shown otherwise in the Contract Drawings.

F. Screened/Sifted Topsoil. In existing urban areas or areas where a lawn-type turf is required, the topsoil shall be top dressed with a minimum of 2-inches of screened/sifted topsoil.

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G. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow, or which may result in contamination and/or silting of the stream.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Topsoil placement and grading shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. No measurement will be made of corrective actions necessary to address erosion and/or settlement of topsoil.

C. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 SALVAGED TOPSOIL

A. Salvaged Topsoil. Where salvaged topsoil from the project site is used to replace planned quantities of topsoil, no additional payment shall be made for removal and processing of salvaged topsoil. All work to remove, stockpile, process, place and grade salvaged topsoil shall be considered inclusive to Topsoil Placement and Grading.

4.03 TOPSOIL PLACEMENT AND GRADING

A. Topsoil Placement and Grading, Inclusive. When no quantity is provided, topsoil placement and grading shall be considered inclusive to unclassified excavation.

END OF SECTION

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SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.03 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to execute the seeding for this project. All areas disturbed by the construction and not covered with pavement, aggregate base course, sod, or other structures shall be seeded, fertilized and mulched.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Subgrade Preparation - Division 31

D. Trenching and Backfilling - Division 31

E. Erosion and Sedimentation Controls - Division 31

F. Topsoil Placement and Grading - Division 32

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 SEED

A. Seed shall conform to Section 630 of the State of Wisconsin, Department of Transportation, Standard Specifications.
   1. Mixture. Unless specified otherwise, the Contractor utilize the following seed mixtures:
      a. Lawn areas shall be No. 40
      b. Slope areas shall be No. 20
      c. Native areas and pond slopes shall be No. 75 unless otherwise otherwise specified.
   2. Nurse crop shall be annual oats prior to September 1. Nurse crop shall be winter wheat or annual ryegrass for the remainder of the year.

2.02 FERTILIZER

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A. Fertilizer shall contain the following percentages by weight:

Nitrogen	(N)	20%
Phosphorus	(P)	10%
Potash	(K)	10%

B. If local ordinances restrict the use of phosphorus in fertilizer, the local restrictions shall supercede the above percentages.

2.03 MULCH

A. Mulching shall consist of any straw, hay, wood excelsior fiber or other suitable material of a similar nature, which is substantially free of noxious weed seeds and objectionable foreign material.

2.04 WATER

A. Water shall be clean and free of impurities or substances that might injure the seed or grass.

PART 3 EXECUTION

3.01 SEEDING

A. Seeding shall be done in conformance with Subsection 630.3 of the State of Wisconsin, Department of Transportation, Standard Specifications. Seed shall be sown at a rate of four pounds per 1,000 square feet unless otherwise specified.

B. A nurse crop shall be sown with the seeding at a rate of four pound per 1000 square feet of area.

3.02 FERTILIZER

A. Apply fertilizer in conformance with Section 629 of the State of Wisconsin, Department of Transportation, Standard Specifications.

B. Deliver fertilizer to site in original unopened containers showing manufacturer's name, guaranteed analysis and weight. Store in a weatherproof location and use only when dry and free flowing. Apply fertilizer at rate of 10 pounds per 1000 square feet and evenly mix into top 2 inches of topsoil.

C. At the Contractor's option, the Contractor may perform soil tests and apply fertilizer based on the results.

3.03 MULCHING

A. This work shall consist of furnishing, placing, and anchoring a mulch cover over seeded areas.

B. Construction shall be done in conformance with Section 627 of the State of Wisconsin, Department of Transportation, Standard Specifications.

C. In existing developed areas, mulching shall be done in such a manner to prevent dust and mulch from being deposited on non-seeded areas. Acceptable methods are by hand or a small chopper/mulcher with a controlled discharge.

3.04 ACCEPTANCE

A. The work will be considered acceptable after a 3-inch uniform stand of grass is attained and all gullies, rivulets, and washouts have been repaired to the satisfaction of the Engineer. The Contractor shall request the Engineer's inspection and acceptance will be made in writing when the above conditions have been complied with. Contractor shall make all corrective actions necessary to attain acceptance.

3.05 WATERING

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A. If weather conditions are not suitable establishing turf, the seeded areas shall be watered twice weekly. Water shall be applied uniformly and in such a manner as not to waterlog the topsoil, dislodge the seed, or cause erosion.

B. If water is provided by a water utility, the Contract shall maintain a record of the amount of water obtained and provide it to the utility.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Seeding shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. No measurement will be made of corrective actions necessary to address erosion or non-establishment of vegetation.

C. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 WATERING

A. Watering, Inclusive. When no quantity is provided, payment for watering shall be considered inclusive to payment for seeding.

END OF SECTION

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SECTION 33 05 26.16
TRACER WIRE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS (NONE)

1.03 DESCRIPTION OF WORK

A. Contractor shall install tracer wire in conjunction with buried, non-metallic sanitary piping in accordance with the contract drawings and the requirements of the Engineer.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Public Sanitary Utility Sewerage Pipe – Division 33

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to these specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 TRACER WIRE

A. For direct burial installations, tracer wire shall be No. 12 gauge, ASTM D 1248, solid insulated copper wire rated for wet conditions.

B. Tracer wire for sanitary sewerage utilities installation shall have green colored insulator.

2.02 TERMINAL LOCATION BOXES

A. Tracer wire terminal location boxes shall be Valvco or equal, with a cast iron lockable top. Cast iron tops shall be appropriately labeled, “WATER” or “SEWER” .

PART 3 EXECUTION

3.01 INSTALLATION

A. Tracer wire shall be installed in conjunction with all PVC and HDPE utilities and installed continuous to the greatest extent possible and in accordance with the contract drawings and the requirements of the Engineer.

B. For open cut installations, wire shall be placed along the top of the entire length of the pipe, and taped to the pipe at intervals not exceeding 10-feet.

C. Wire shall surface at structures, above laterals at the property line, or manholes. Where spacing of these appurtenances exceeds 400 feet; terminal location boxes shall be installed. Terminal location boxes shall

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be located by the Contractor to meet the maximum spacing or as called out in Special Procedures, Division 1 or as shown on the Contract Drawings.

1. Within valve boxes, the wire shall be installed in ½-inch PVC conduit beginning below the valve nut terminating six inches below the finished grade.
2. At manholes, the wire transition from outside to inside the manhole shall be watertight.
3. Adjacent to hydrants, the wire shall terminate in a terminal location box.

D. Eighteen inches of extra wire shall be provided at all terminations.

E. Splices in the wire shall be held to a minimum. Where splices are necessary, they shall be made with underground rated mechanical wire connectors or by twisting the wires a minimum of 4 times and soldering, then wrapping with two layers of polyethylene tape to 6-inches beyond the stripped wire. Splicing with wire nuts shall not be allowed.

3.02 TESTING

A. All tracer wire must pass a locating test. Locates shall be done in the presence of the Engineer prior to acceptance of respective pipe installation. All equipment necessary to make the test shall be provided by the Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 TRACER WIRE

A. Tracer Wire Testing, Inclusive. All testing shall be inclusive to the payment for the respective utility. Payment for utilities requiring tracer wire will not be issued until an accepted locate has been performed and accepted by the Engineer.

4.02 TRACER WIRE TERMINAL LOCATION BOXES

A. General. Tracer wire terminal location boxes shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 1.

1. Tracer Wire Terminal Box, Inclusive. When no quantity is provided, tracer wire terminal boxes shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 33 10 00
WATER UTILITIES

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute (ANSI) and American Water Works Association (AWWA), Specifications and Standards:
      a. ANSI/AWWA C104/A21.4 - American Water Works Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, Current Edition.
      b. ANSI/AWWA C105/A21.5 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems, Current Edition.
      c. ANSI/AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings for Water, Current Edition.
      d. ANSI/AWWA C111/A21.11 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, Current Edition.
      e. ANSI/AWWA C151/A21.51 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, Current Edition.
      f. ANSI/AWWA C153/A21.53 - American National Standard for Ductile-Iron Compact Fittings for Water Service, Current Edition.
      g. ANSI/AWWA C502- American Water Works Association Standard for Dry-Barrel Fire Hydrants, Current Edition.
      h. ANSI/AWWA C504 - American Water Works Association Standards for Rubber-Seated Butterfly Valves, Current Edition
      i. ANSI/AWWA C509- American Water Works Association Standard for Resilient-Seated Gate Valves for Water Supply Service, Current Edition.
      j. ANSI/AWWA C515 – American Water Works Association Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service, Current Edition.
      k. ANSI/AWWA C600 – American Water Works Association Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances, Current Edition.
      l. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water, Current Edition.
      m. ANSI/AWWA C651 – American Water Works Association Standard for Disinfecting Water Mains, Current Edition.
      n. ANSI/AWWA C800 – American Water Works Association Standard for Underground Service Line Valves and Fittings, Current Edition.
      o. ANSI/AWWA C900 – American Water Works Association Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 60-inch, for Water Transmission and Distribution, Current Edition.
      p. ANSI/AWWA C901 – American Water Works Association Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½-inch through 3 inches for Water Service, Current Edition.
      q. ANSI/AWWA C906 – American Water Works Association Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards:
      a. ASTM A536 – Standard Specification for Ductile Iron Castings.
      b. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation, Current Edition.
      c. ASTM D1598 – Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure, Current Edition.

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d. ASTM D1599 – Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings, Current Edition.
e. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120, Current Edition.
f. ASTM D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter, Current Edition.
g. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series), Current Edition.
h. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, Current Edition.
i. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, Current Edition.
j. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40, Current Edition.
k. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, Current Edition.
l. ASTM D2513 – Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings, Current Edition.
m. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
n. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
o. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings, Current Edition.
p. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter, Current Edition.
q. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals, Current Edition.
r. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, Current Edition.
s. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Material, Current Edition.
t. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, Current Edition.
u. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing, Current Edition.
v. ASTM B88 – Standard Specification for Seamless Copper Water Tube

3. Factory Mutual Research (FM), Specification and Standards, Current Edition.
4. National Fire Protection Agency (NFPA 24).
5. Underwriters Laboratories, Inc. (UL) Specifications and Standards, Current Edition.

1.04 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing all materials, equipment, labor and supervision required for water main, water service and other appurtenant materials, installed for the transmission and/or distribution of potable water, as shown on the contract drawings and as specified herein.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. Geosynthetics for Earthwork - Division 31

D. Trenching and Backfilling - Division 31

E. Erosion and Sedimentation Controls - Division 31

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F. Tracer Wire – Division 33

1.06 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

B. Contractor shall submit such submittals and details required for the construction and installation of the materials. Submittals and details shall indicate the intended materials arrangement, dimensions, major support requirements, plot area and intricate or detailed construction requirements.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 PIPE

A. All water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Shall be Thickness Class 52 meeting the requirements of ANSI/AWWA C151/A21. Standard cement-mortar lining shall meet the requirements of ANSI/AWWA C104/A21.4. Pipe shall have minimum of 1 mil asphaltic outside coating in accordance with ANSI/AWWA C151/A21.51. Spotty or thin seal coating, shall be cause for rejection.

B. All water main 2-inches in diameter or less shall meet the following minimum requirements:
1. Copper pipe shall be Type K copper tubing, ASTM B88, and shall conform to the sizing requirements of ANSI/AWWA C800.

2.03 FITTINGS

A. All fittings for water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Full body fittings shall conform to ANSI/AWWA C110/ A21.10 and ANSI/AWWA C111/A21.11 with bituminous coating. Compact fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/21.11 with bituminous coating. All fittings shall be provided with cement mortar lining conforming to ANSI/AWWA C104/A21.4.

B. Bolts shall be Cor-Blue.

2.04 JOINTS

A. All joints for water main 3 inches in diameter or larger shall meet the following minimum requirements:
1. Ductile Iron Pipe. Joints shall be either push-on or mechanical joint conforming to ANSI/AWWA C111/A21.11 unless specified otherwise. All joints, fittings, etc., shall be equipped to provide electric continuity. The continuity must be provided through the use of a trademarked, well-established method acceptable to the Engineer.

B. All joints for water main requiring joint restraint shall meet the following minimum requirements:
1. Mechanical Joints. Mechanical joints shall be installed with wedge action restraining glands, Mega-Lug by EBAA Iron Sales, Inc. or equal. Where noted on the drawings, the Contractor shall provide Tandem Mega-lug restraints at buildings.
2. Push-on Joints. Restrained push-on joints for straight pipe shall be as shown on the plans or as recommended by Pipe Manufacturer. Restrained joint retainer rings shall be manufactured of ductile iron compatible with pipe. All nuts, bolts, and tie rods shall be stainless steel or with a corrosion-resistant coating. Restraints shall be Mega-Lug by EBAA Iron Sales, Inc. or equal.
3. All restrained joints shall have a pressure rating equal to that of the pipe.

2.05 VALVES

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A. All valves for water main 3 inches thru 12 inches in diameter shall meet the following minimum requirements:
   1. Valves shall be resilient-seated gate valves, mechanical joint conforming to ANSI/AWWA C509 or ANSI/AWWA C515 unless specified otherwise.
   2. Valves shall have non-rising stem, with 2 inch operating nut opening counter-clockwise.
   3. The valve wedge shall be ductile iron fully encapsulated with EPDM rubber, shall be symmetrical and seal equally well with flow in either direction.
   4. Operating nut extensions shall be provided where required by Contract drawings and/or Special Procedures.

B. All valves for water main 2 inches in diameter or less shall meet the following minimum requirements:
   1. Mueller Mark II Oriseal, or equal

C. All valves for water main larger than 12 inches in diameter shall meet the following minimum requirements:
   1. Valves shall be rubber-seated butterfly valves, mechanical joint conforming to ANSI/AWWA C504 unless specified otherwise.
   2. Valves shall have non-rising stem, with 2 inch operating nut opening counterclockwise.

D. Valves shall be installed with the following accessories:
   1. Valve Box. Valve box shall consist of a top section, bottom section, base, drop lid, and necessary extensions and all shall be cast iron. Lid shall have the word “WATER” cast on the lid.
   2. Valve Box Adaptor.
      a. Gate Valves: All gate valves 4 inch or larger shall be installed with a Gate Valve Adaptor as manufactured by Adaptor Inc., or equal.
      b. Butterfly Valves: All butterfly valves between 16 inch and 36-inch in diameter shall be installed with a Butterfly Valve Adapter as manufactured by Adaptor Inc., or equal.

2.06 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall be polyethylene film tube, 8 mil nominal thickness, conforming to ANSI/AWWA C105/A21.5. Polyethylene film sheet conforming to ANSI/AWWA C105/A21.5 may be used at odd-shaped appurtenances where the use of tube is not practical.

B. The polyethylene film shall be clearly marked with the information required in ANSI/AWWA C105/A21.5.

C. Polyethylene encasement shall be repaired around all corporation/saddles and other appurtenances after initial installation. Encasement shall be neatly cut around corporations/saddles and repaired with suitable tape/adhesive to protect the pipe from native soils and bedding.

2.07 INSULATION

A. Insulation shall be extruded polystyrene insulation (25 psi) conforming to ASTM C578, Type IV in 4 foot x 8 foot sheets with minimum thickness of 2 inches.

PART 3 EXECUTION

3.02 GENERAL

A. All construction shall be done in conformance with ANSI/AWWA C600 unless otherwise specified.

3.03 EXCAVATION

A. Excavation shall conform to Trenching and Backfilling - Division 31 of these specifications except as modified herein.

3.04 FIELD INSPECTION OF MATERIALS

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A. Before lowering and while suspended, the pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection. Contractor shall inspect each segment of pipe for the presence of foreign matter, rough edges or projections within the pipe. Contractor shall take care to prevent any foreign material from entering pipe prior to installation.

3.05 DIRECTION OF LAYING

A. Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds 30 feet of rise per one hundred feet of trench, the bells shall be face upgrade.

3.06 INSTALLATION

A. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench.

B. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings so as to prevent breakage. Under no circumstances shall they be dropped into the trench or so handled as to receive hard blows or jolts when being moved.

C. The Contractor shall supply and install pipe fittings, couplings, bends, and appurtenances as required to complete the project.

D. All tees, crosses, bends, and reducers shall be cast or ductile iron. No PVC appurtenances will be allowed.

E. Contractor shall install temporary water service to all users where water service will be interrupted for more than 4 hours. Contractor shall coordinate interruption to business and commercial users so the interruption will not cause a disruption of business or commercial activities. All users shall be given 24 hour notice of service interruption, except during emergencies.

F. Abandoned water mains or hydrant leads shall have their ends plugged with concrete.

G. All existing water mains being replaced are to remain in service until the new water mains are tested and accepted. The Contractor shall make arrangements with the Owner and the Engineer to sequence connection and operation of new mains and abandonment of existing mains. A minimum of 24 hours notice to residents shall be provided prior to shutting off their water.

H. Unless pre-approved by the Owner and Engineer, the maximum allowable duration of water service interruption to water utility customers shall be typically be 4 hours. Customers to whom water service is critical, shall have service interruption limitations and accommodation needs determined on a case by case basis.

3.07 JOINING OF PIPE

A. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.

B. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

3.08 CUTTING OF PIPE

A. Pipe shall be cut at right angles to the centerline of the pipe. Cutting shall be done in a neat workmanlike manner without damage to the pipe and so as to leave a smooth end.

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B. All pipes shall be cut with an approved mechanical cutter. The cut end of a pipe to be used with rubber gasket joints shall be tapered by grinding or filing about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.

3.09 OBSTRUCTIONS IN LINE OR GRADE

A. Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor will furnish and install the required fittings.

B. If an unknown underground structure interferes with the work to such an extent that an alteration of the plan is required, the Contractor shall notify the Engineer.

3.10 THRUST RESTRAINT

A. Thrust restraint is required for all bends, caps, plugs, tees, and valves adjacent to tees. Thrust restraint shall be provided by use of concrete buttresses and wedge action restraining glands.

B. Concrete buttresses shall be poured against firm, undisturbed ground. When concrete buttresses cannot be placed against undisturbed ground they shall be placed against fill material of composition conforming to the requirements of ASTM C12 or ASTM D2321 as applicable for rigid and flexible pipe respectively, compacted to 95 percent of the modified proctor density for the material. The buttresses shall be constructed to the minimum dimensions as shown on the contract drawings or as required by the Engineer. All buttresses shall be formed to keep the joints free of concrete.

C. Solid precast concrete blocks may be used in lieu of the poured buttresses when approved by the Engineer. When concrete blocks are used, they shall be stepped-out to match the minimum dimensions required for poured concrete buttresses.

D. Ductile iron or PVC pipe connecting to HDPE pipe must be restrained a sufficient distance upstream to prevent joint separation due to contraction of the HDPE pipe. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Procedures - Division 01. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction.

E. Restrained joint fittings shall be used in conjunction with concrete buttresses. When restrained joint fittings are used, a sufficient length of pipe on each side of the fitting shall be restrained to resist the thrust forces. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Procedures - Division 01.

F. Thrust restraint is not required for HDPE water mains with HDPE fittings except where transitioning to other pipe materials.

3.11 JOINT DEFLECTION

A. The maximum allowable deflection for ductile iron pipe will be as given in ANSI/AWWA C600. If excess deflection is required, special bends shall be furnished to provide angular deflections.

B. The maximum deflection shall be as specified by the manufacturer.

3.12 DEPTH

A. The water main shall be placed at a depth as to prevent freezing. This depth shall provide eight (8'-0") of cover over iron/copper pipe and one-half foot more for other materials unless otherwise shown on the contract drawings or required by Special Procedures - Division 01 of these specifications.

B. Insulation shall be installed if ground cover is less than eight (8'-0") or utility crossing effectively removes earthen freeze protection. Insulation shall be installed as shown on the contract drawings or as directed by the Engineer in the field.

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3.13 UNSTABLE SOIL

A. If in the opinion of the Engineer the trench bottom is of unstable material, the Engineer may direct the Contractor to excavate the unstable material and replace same with 3/4 inch washed stone. Washed stone used in such cases shall be considered incidental and included in the price bid for water main unless bid or specified otherwise. Where the condition of unstable material is unusually severe, the Engineer may order the placement of a concrete cradle. Materials used for concrete cradles, when not called for in the Contract Documents, shall be paid for by Change Order at a negotiated price.

3.14 EMBEDMENT/BEDDING

A. Class B bedding and initial backfill shall be used for all ductile iron or HPDE pipe installed under this contract in accordance with the contract drawings and ASTM C12, or as indicated in Special Procedures - Division 01 of these specifications.

B. Class II embedment shall be used for all PVC pipe installed under this contract in accordance with the contract drawings and ASTM D2321, or as indicated in Special Procedures - Division 01 of these specifications.

3.15 SETTING VALVES

A. Valves in water mains shall be provided and installed in locations as shown on the contract drawings. A valve box and valve box adaptor shall be provided for every valve unless otherwise specified. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve. The box cover shall be 1/4 inch to 1/2 inch lower than the surface of the finished pavement.

B. HDPE by mechanical joint adapters must be used at all valves installed on HDPE pipe.

3.16 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall be installed where shown in the contract drawings or as required in the Special Procedures - Division 01. Installation of polyethylene encasement shall conform to ANSI/AWWA C105/A21.5l.

B. The polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as joints or fittings, and to prevent damage to the polyethylene caused by backfilling operations. Overlaps and ends shall be secured with adhesive tape or plastic tie straps. For installations below the water table, circumferential wraps of tape shall be placed at two foot intervals along the barrel of the pipe.

C. All fittings and valves shall be fully wrapped with polyethylene.

D. Exposure to sunlight of the polyethylene film shall be kept to a minimum.

3.17 TRACER WIRE

A. Trace wire shall be installed in conjunction with all PVC, HDPE, or non-conductive water main and services in accordance with Tracer Wire – Division 33 and with the Contract Drawings and the Special Procedures – Division 01.

3.18 DISINFECTING WATER MAIN

A. All water main and services shall be disinfected in conformance with ANSI/AWWA C651. The main will not be accepted or placed in service until two consecutive satisfactory tests are taken 24 hours apart from samples from the new main following the final flushing.

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B. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set of samples from the end of the main and a minimum of one set from each water main branch.

C. The testing lab shall furnish copies of lab results from the bacteriological tests run on the water mains to the Engineer.

3.19 WATER SUPPLY DECHLORINATION

A. Chlorinated water discharged directly or indirectly to surface waters as a result of flushing newly installed water mains, discharging water tanks or reservoirs, hydrant flushing, test pumping wells, or any other circumstance shall be dechlorinated in accordance with the current "Hydrostatic Test Water or Water Supply System Water General Permit, WPDES Permit No. WI-0057681". The free chlorine residual of discharged water shall be reduced to 0.1 parts per million or less, or to the normal operating concentration of the chlorine residual maintained in the water supply system.

B. The concentration of free chlorine residual shall be measured at the point of surface water entrance.

3.20 TESTING

A. All equipment required for hydrostatic testing shall be furnished and operated by the Contractor subject to the approval of the Engineer. This equipment shall include all sampling taps and necessary flushing appurtenances.
   1. Hydrostatic tests shall consist of pressure and leakage test in accordance with ANSI/AWWA C600, Hydrostatic Testing. The hydraulic tests shall be conducted at 150 percent of normal operating pressure or 150 psi, whichever is greater.
      a. Water shall not be added during the pressure test. No pipe section will be accepted if the test pressure drops more than 5 psi within the two-hour test duration.
      b. The leakage is the amount of water required to bring the pressure back up to the starting pressure once the pressure test passes. Contractor shall know and follow the procedures in AWWA C600 for the leakage test and have all required material and equipment necessary to complete this test.
   2. Hydrostatic tests shall be conducted on sections of water main recommended as ready by the Contractor and approved by the Engineer. No section shall be less than one block (approximately 400 feet) of water main unless conditions warrant such testing of smaller sections.
   3. Where water services are installed to facilities which may include fire sprinkler systems, a pressure test and leakage test shall be performed on the water service in accordance with NFPA 24.

B. Where ductile iron water main is installed, a random section of completed main will be selected by the Engineer for a continuity test. This random section shall be subjected to 300 amps DC for 15 minutes. All equipment necessary to make the test and to establish a closed circuit with the test section of water main providing one leg of the circuit shall be provided by the Contractor at no additional cost to the Owner. The Contractor shall take whatever precautions he deems necessary such as filling the water main with water prior to testing to protect the gaskets and building the amperage up slowly while watching an ammeter.
   1. If the random section passes the test, the electrical continuity for the entire water main installation will be considered acceptable.
   2. Should the random section fail the test, it shall be repaired by and at the expense of the Contractor until it can pass the test. Also, the remainder of the project will be divided into test sections by the Engineer and tested for compliance by and at the expense of the Contractor.

C. All tracer wire must be tested for electrical continuity. All equipment necessary to make the test and to establish continuity of all tracer wire shall be provided by the Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.02 GENERAL

A. Water main shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 TESTING

A. Mains shall be installed and pass test for pressure, leakage and safe sample before any water main installation payments shall be made.
   1. The Contractor is responsible for furnishing and operating all water main testing equipment including sampling taps and necessary flushing appurtenances.
   2. After removal, any temporary fittings, valves, and plugs shall become the Contractor's property.

B. Payment for water main requiring tracer wire will not be issued until an accepted continuity test has been performed and approved by the Engineer.

END OF SECTION

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SECTION 33 12 33
PRESSURE REDUCING STATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and install a factory designed and assembled pressure reducing valve station with all necessary internal valves, piping, electrical controls, and accessories.

B. Refer to Sections 26 90 00 and 40 23 23.

C. Factory fabricated enclosure with electrical, and process piping shall be delivered to the site, set on and secured to a precast concrete slab, and connected to associated electrical and water systems. Complete installation shall be complete and functional.

1.02 RELATED WORK ELSEWHERE

A. Cast-in-place Concrete – Division 03

B. Joint Sealants – Division 07

C. High Performance Coatings – Division 09

D. Electrical – Division 26

E. Excavation for Structures – Division 31

F. Granular Fill – Division 31

G. Water Utilities – Division 33

H. Process Piping, Valves, and Specialties – Division 40

1.03 APPLICABLE PROVISIONS

A. Applicable provisions from Division 01 shall govern the work of this section

1.04 SUBITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of the Submittals - Division 01 of these specifications.

B. Product Data: Submit catalog cuts and descriptive information for each component.
   1. Concrete precast slab
   2. Heater
   3. Process Valves
   4. Process Piping
   5. Process Accessories
   6. Instrumentation and Control equipment.

C. Submit color charts for exterior finishes and colors.

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1.05 DELIVERY STORAGE AND HANDLING

A. The completed pressure reducing station shall be one piece when delivered and require only off loading, installation on the prescribed foundation slab, watermain hookup, and electrical service to complete the installation.

1.06 QUALITY CONTROL

A. The complete unit shall be designed, fabricated, and assembled and tested by the manufacturer prior to shipment.

B. The completed pressure reducing valve station shall be UL listed.

1.07 START UP AND OPERATION & MAITENANCE MANUALS

A. After the job installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Four (4) copies of O and M manuals will be supplied to the owner prior to initial operation.

1.08 WARRANTY

A. The manufacturer of the pump station shall guarantee for a period of one year from the date station is placed into operation or eighteen months from date of shipment, whichever occurs first, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the guarantee period, the manufacturer will provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded.

PART 2 PRODUCTS AND MATERIALS

2.01 PREFABRICATED PRESSURE REDUCING STATION

A. The Contractor shall furnish and install a factory designed and assembled, aboveground pressure reducing valve station with all internal valves, piping, electrical controls and appurtenances as shown on the plans and as specified herein.

B. The station shall be complete with all needed equipment factory installed on a common fabricated steel base plate and enclosed within a fiberglass enclosure.

C. The station shall be as manufactured by USEMCO, Inc., Tomah, Wisconsin or approved equal. Where an "approved equal" clause is provided, it is intended that the "equal" material or equipment be approved in writing by the engineer at least 7 days prior to the time of bidding. "Approved equals" not submitted 7 days prior to the bid will not be considered.

D. To ensure total quality control, the complete unit shall be designed, fabricated, assembled and tested in-house by the station manufacturer.

E. The station’s incoming electrical service shall be 240 volt, 1 phase, 60 hertz, 3 wire electrical service.

2.02 EQUIPMENT CHAMBER

A. The equipment chamber common base shall be fabricated from a minimum 3/8" structural steel plate, reinforced with adequate sized steel channels to prevent deflection due to equipment weight and stresses imposed from lifting and setting equipment.

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B. Bolt on lifting eyes shall be placed about the perimeter of the equipment base to facilitate lifting and handling of the station. The lifting eyes shall be easily removable after the station has been set in place. The steel plate and structural steel employed in the equipment base shall meet or exceed the requirement of ASTM-A36.

C. The equipment enclosure shall be a hinged cover with a suitable drip-lip around the bottom edge. The cover shall be provided with a latch open device of adequate strength to keep the cover safely in the open position under any wind condition. An adjustable ventilation louver shall be provided in the cover which shall be capable of being closed during cold weather operation.

D. The fiberglass cover will be gel coated inside and out and be of suitable thickness and density formulated to provide durability, abrasion resistance, and color fastness. The coating will also be impervious to sewage, grease, oil, gasoline, and other common chemicals. The exterior finish will consist of 20 to 25 mils of gel coat with an added UV absorber. Fiberglass laminate will then be applied to the backside of the gel coat to an approximate thickness of 1/8". This laminate will be a 25% to 28% chop glass load by weight. The laminate will be rolled out to remove all air and then allowed to cure. Foam insulation board with an R-value of 7.5 and an aluminum laminate vapor barrier will then be applied and bonded into place. A light layer of laminate is chopped on top of the foam sheet and rolled out to remove air and allowed to cure. A cover coat of gel coat with a surfacing agent is then applied on the inside of the part and allowed to cure.

E. The exterior shall be a white textured surface. Smooth and/or glossy exteriors will not be acceptable and will not be considered due to their appearance and reflectivity characteristics.

F. The cover shall also be provided with suitable lifting handles, and a hasp staple connection to allow the chamber to be locked by a padlock.

2.03 WELDING

A. All welding shall be in accordance with standard AWS practices, with proper fillet section and continuity to assure a sound, watertight structure. All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. Butt welds shall be used for all welded joints in line pipe assemblies. Fillet welds shall be used for flange attachment in accordance with AWWA C207. All welds in contact with soil or water shall be tested with a dye penetrant to assure the watertight integrity of the weld system.

2.04 PROTECTIVE COATINGS

A. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by shot blasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding.

B. All steel surfaces shall receive a minimum of two coats of hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products, and salt solutions. The coatings shall be applied to 3 mils dry film thickness each coat.

C. Piping interior shall have a fusion bonded epoxy coating applied after shotblasting. The coating shall meet AWWA C-213 standards and be applied to a minimum thickness of 12 mils.

D. A paint touch-up kit shall be provided with the station for coating areas damaged in shipping.

2.05 ENCLOSED LOAD CENTER

A. The load center shall be a 100 amp rating with spaces for 6 individual 15 amp breakers and a main breaker with connecting lugs. The load center will have a NEMA I type enclosure with cover and interior assembly.

B. Refer to Division 26 for additional electrical requirements.

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2.06 WIRING

A. All wiring shall comply with the National Electric Code and applicable state and local codes. Wiring shall be completely factory installed except for the power lines that run to the control panel continuously from the external disconnect switch.

B. All wiring within the equipment chamber and outside the control panel shall be run in PVC rigid conduit except for the liquid tight metallic flexible conduit to connect the pump motors. Accessory items such as the sump pump, dehumidifier, etc. with approved manufacturer's rubber cord may be plugged into polarized grounded outlets.

C. It shall be the responsibility of the local electrical contractor to furnish and install correctly sized service wires from the service pole outside the equipment chamber to the control panel. It shall also be the responsibility of the electrical contractor to furnish and install, if required, any exterior disconnects or switching mechanisms.

D. Refer to Division 26 for additional electrical requirements.

2.07 PIPE AND FITTINGS

A. Refer to Section 40 23 23.

B. Refer to drawings.

2.08 PRESSURE GAUGES

A. Refer to Section 40 23 23.

B. Refer to drawings.

2.09 ELECTRONIC INTERFACE CONTROL VALVE

A. Electronic interface control valve (Pressure Control Valve) shall be a 8-inch Model 131-KW with pressure sustaining, pressure reducing, pressure relief override, and return flow features.

B. Valve shall be manufactured by Cla-Val as represented by Dorner, Inc.

C. Valve body shall be flanged (150#), globe style with stainless steel trim with fusion bonded epoxy.

D. The Electronic interface control valve shall be furnished an installed with the following features:
   1. CL/CRL 60 Pressure Relief control
   2. Equipped with pilot system isolation cocks
   3. Check feature
   4. X117D Valve position transmitter.

E. Valve shall be provided with a manufactured VC-22D electronic valve controller with Ethernet module.

F. Valve shall accept control signal to adjust flow rate and pressure control setpoints. Valve shall accept control signal from a SCADA system.

G. Shall automatically relieve pressure from high zone back to primary zone if pressure exceeds 80 psi setpoint.

H. Shall prevent flow from normal primary to high zone, unless in pressure reversal.

I. Shall flow from high zone back to primary upon solenoid selection with pressure controls per setpoints below:
   1. Backpressure sustaining 65 psi
   2. Pressure reducing 48 psi

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2.10 BUTTERFLY VALVES

A. All butterfly valves shall be lugged style. No wafer butterfly valves will be permitted in the station.

B. The valve body shall be of cast iron construction with a centering rib to assure accurate positioning. The valve stem shall be of full diameter through the valve body and be isolated from the fluid medium. The valve disc shall be of ductile iron accurately machined for proper contact with the replaceable a seating surface.

C. Valves shall be equipped with totally enclosed gear operators with hand wheels with arrow cast in metal to indicate direction of opening.

D. Valves shall meet AWWA C504.

E. AWWA Butterfly valves shall be as manufactured by DeZurik, Valmatic, M&H, or equal.

2.11 BALL VALVES

A. Small Diameter General Purpose Ball Valves
   1. Ball valves, 2 inch and smaller, shall be end entry type, full port, with threaded end connections.
   2. Body shall be full bore 316 stainless steel, two-piece body with vented stainless steel ball and stem.
   3. Seats and seals shall be PTFE.
   4. Provide hand lever operator with stops at the full open and full closed positions.
   5. Valves shall be rated for 400 psi service.
   6. Valves to be Ladish, Apollo, or equal.

2.12 MAGNETIC FLOW METER

A. Refer to Section 40 23 23 for water meter requirements.

B. Refer to drawings.

2.13 VENTILATION SYSTEM

A. A ventilating system shall be provided to remove excessive heat from the equipment chamber due to continuous motor operation.

B. The blower shall be of the centrifugal, squirrel cage design rated for 135 CFM with a statically balanced wheel to assure quiet performance and maximum air delivery.

C. Automatic control of the exhaust blower shall be thermostatically controlled

D. The blowers motor shall operate on an independent 120 volt, single phase A.C. power source with single pole, 15 amp circuit breaker protection.

2.14 HEATER

A. The equipment chamber shall be provided with a 3000-watt electric heater suitable for 240 volt, single-phase service. The heater shall be of the fan-forced, with fan delay, and complete with an integral, automatic, snap action thermostat. Fan motor is to be totally enclosed and impedance protected. The heater shall be wall mounted, with an 18-gauge steel grille surface-mounting frame. Heater shall be hard wired into the station electrical system.

2.15 PRECAST CONCRETE FOUNDATION SLAB

A. The contractor shall provide a precast concrete foundation slab suitable for bearing the load of prefabricated pressure reducing valve station meeting the following requirements:
   1. Slab length and width shall be a minimum of 4 inches large than the enclosure footprint. Contractor shall coordinate with Pressure Reducing Station manufacturer.

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2. The slab shall have minimum thickness of 12 inches.
3. Slab shall be reinforced.

2.16 RIGID INSULATION

A. Insulation shall be extruded polystyrene insulation (25 psi) conforming to ASTM C578, Type IV in 4 foot x 8 foot sheets with minimum thickness of 4 inches.

2.17 PIPE SUPPORTS

A. Refer to Section 40 23 23 – Process Piping, Valves, and Specialties.

B. Refer to contract drawings.

PART 3 CONSTRUCTION METHODS

3.01 INSPECTION AND TEST

A. Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

3.02 PIPING CONNECTIONS

A. All mechanical joints between field installed watermain and prefabricated station piping shall be located above grade.

B. The station manufacturer shall provide adequate piping supports such that station piping can be fabricated and secured prior to arrival to the installation site.

3.03 INSULATION

A. Insulation shall be installed as shown on the contract drawings.

B. Wooden stakes or posts shall be used to stabilize and support vertical sheets of insulation square and plumb to watermain piping.

C. All joints shall be taped and sealed.

PART 4 MEASUREMENT AND PAYMENT

4.01 PREFABRICATED PRESSURE REDUCING STATION

A. Pressure Reducing Station, Each. Payment for providing, installing, and starting up meter station shall be for each unit successfully installed.

END OF SECTION

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SECTION 33 31 13
PUBLIC SANITARY UTILITY SEWERAGE PIPE

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover furnishing and installing all pipe and fittings for the sanitary sewer as shown on the contract drawings and as specified herein.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Trenching and Backfilling - Division 31

C. Erosion and Sedimentation Controls - Division 31

D. Sanitary Sewer Manholes - Division 33

E. Tracer Wire – Division 33

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

B. Contractor shall submit such submittals and details required for the construction and installation of the materials. Submittals and details shall indicate the intended materials arrangement, dimensions, major support requirements, plot area and intricate or detailed construction requirements.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.01 PIPE

A. PVC Pipe. Four inch to 15-inch diameter pipe shall be Type PSM SDR-35 and meet the requirements of ASTM D3034. Pipe over 15-inch diameter shall meet the requirements of ASTM F679. Pipe shall be of the bell and spigot type.

B. PVC Pipe. Pipe within 5 feet of building foundations shall be PVC Schedule 40 drain waste vent piping.

2.02 PIPE JOINTS

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A. General. Manufacturer's instructions for making joints shall be followed. The use of joints as specified herein shall not relieve the Contractor of the responsibility of meeting testing specifications.

B. PVC Pipe. Pipe joints shall be elastomeric seals (rubber gaskets) conforming to ASTM F477 and joint assembly conforming to ASTM D3212.

PART 3 EXECUTION

3.01 GENERAL

A. All construction shall be done in conformance with "Standard Specifications for Sewer and Water Construction in Wisconsin" except as may be modified herein.

B. Plastic pipe shall be installed in accordance with ASTM D2321.

3.02 LINES AND GRADES

A. All lines and grades will be given on the contract drawings, as directed by the Engineer or as indicated in Special Procedures - Division 01 of these specifications. The Contractor shall be responsible for the preservation of line and grade stakes when set. The Contractor shall keep the Engineer informed reasonably in advance of the times and places that stakes will be required in order that the work may be done without inconvenience to the Engineer or delay to the Contractor.

B. The Contractor shall at his own expense, furnish and place in position, as directed by the Engineer, all necessary equipment and material for locating the work from the line and grade stakes provided by the Engineer. It shall be the Contractor's responsibility to check grade stakes in advance of the excavation reporting any discrepancies to the Engineer.

C. Sanitary sewer pipe shall be laid at a constant grade and alignment between manholes with no sags or bends in the pipe. Contractor assumes responsibility for the vertical and horizontal alignment of the installed pipe (i.e. sags and bends) and shall correct these deficiencies as his expense.

3.03 EXCAVATION

A. Excavation shall conform to both Trenching and Backfilling and Structural Excavation for Structures - Division 31 except as modified herein.

3.04 UNSTABLE SOIL

A. If in the opinion of the Engineer the trench bottom is of unstable material, the Engineer may direct the Contractor to excavate the unstable material and replace same with 3/4 inch washed stone. Washed stone used in such cases shall be considered incidental and included in the price bid for sanitary sewer unless bid or specified otherwise.

B. Where the condition is unusually severe, the Engineer may order the placement of a concrete cradle, which shall be paid for at the unit price bid.

3.05 EMBEDMENT

A. Embedment for the sewer pipe shall depend upon whether the pipe is rigid, semi-rigid or flexible.

B. Rigid pipe, including clay, concrete, and ductile iron pipes, shall be embedded in accordance with ASTM C12, Class B embedment, unless specified otherwise in the Special Procedures or as shown on the Contract Drawings. The Class B embedment material shall be placed in maximum lifts of 6 inches and extend a minimum of 12 inches above the top of the pipe.

C. Flexible and semi-rigid pipe, including PVC, shall be embedded in accordance with ASTM D2321, Class II embedment, unless specified otherwise in the Special Procedures or as shown on the Contract Drawings.

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The Class II embedment material shall be placed in maximum lifts of 6 inches and extend a minimum of 12 inches above the top of the pipe.

3.06 INSTALLATION

A. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe into the trench. Extreme care shall be exercised by the Contractor in handling all pipe so as to prevent breakage. Under no circumstances shall they be dropped into the trench or so handled as to receive hard blows or jolts when being moved.

B. Before lowering and while suspended, the pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection.

C. Unless otherwise ordered, pipe shall be laid with the bell ends facing upgrade.

D. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line.

E. Joints shall be lubricated, cemented, or otherwise made in strict conformance with these specifications and manufacturer's instructions.

F. Sewers to be stubbed out from new manholes shall end with a pipe bell end and have the end plugged to prevent the entrance of soil and water. The cost of plugs shall be included in the unit price bid of the sanitary sewer.

3.07 CONNECTION TO EXISTING

A. The Contractor shall verify the location, size, depth and material of the existing sanitary sewer or lateral and shall provide all necessary materials and labor to make a watertight connection. The contractor shall report any discrepancies between contract drawings and field conditions to the Engineer.

3.08 LATERALS OR CONNECTIONS

A. Wyes or tee branches for lateral service connections shall be placed to service each building site as directed by the Engineer. All wyes, tees or the end of lateral service lines shall be closed with a stopper until all testing has been completed. Plugs/caps shall be tested against with the maximum air pressure to be used in testing. All deep connections shall be fitted with riser pipes when ordered by the Engineer. Risers shall not exceed a 1:1 slope and shall be paid for per foot of pipe length as sanitary lateral.
   1. Sanitary laterals shall be SDR 35. All laterals shall be installed up to the right-of-way line and be embedded in materials in accordance with ASTM C12 or ASTM D2321 for rigid, semi-rigid or flexible pipe as specified.
   2. Minimum grade of lateral shall be 1/8 inch per foot. Maximum grade of lateral shall be 1/2 inch per foot.
   3. All unconnected sanitary laterals shall be capped and have the ends marked by a metal fence post buried vertically, flush with the ground directly over the end of the lateral. The cost of the fence post and cap shall be included in the unit price bid for sanitary lateral.
   4. All sanitary laterals must be insulated if the depth of cover is 5-1/2 feet or less when rock is present. If the depth of hard rock is 4-1/2 feet or less, the rock shall be removed to at least 5-1/2 feet of cover and the service insulated.

B. Where new sewer is to be installed to replace existing sanitary sewer, service laterals shall be extended from the old sanitary lateral and connected to the new main. Minimum grade of lateral extensions shall be 1/8 inch per foot. Maximum grade of lateral extensions shall be 1/2 inch per foot. Lateral extensions which require a grade in excess of 1/2 inch per foot to connect new sewers to existing service laterals shall be installed with a riser section. Connection to existing laterals shall be made with a stainless steel reinforced rubber connection, Fernco Strongback coupling or equal in accordance with State and/or local plumbing code requirements. The cost of all special fittings required to make the connections of service

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laterals to the new sanitary sewer and the connections to the lateral shall be included in the bid. Where pipes of differing diameters are connected, eccentric couplings are required.

1. Approximate locations of existing laterals are shown on the contract drawings. The Contractor shall verify the size and location of all existing laterals. The Contractor shall coordinate, with the Engineer, verification that existing laterals that are encountered are live and that all live laterals are connected to the new sewer main.
2. Where existing lateral size does not match the size of the new sewer lateral size the Contractor shall inform the Engineer prior to connection. In no case shall the Contractor connect a larger existing lateral to a smaller proposed downstream lateral.

C. Saddle wyes shall be used when connecting to an existing sanitary sewer main. Saddle wye shall be one of the following or Engineer approved equal.

1. Geneco SEALTITE® Type "8C" multi-range sewer saddle.
2. ROMAC CB Sewer Saddle.

D. A complete and accurate tabulation of the length, location, depth, etc., of each lateral installed shall be kept by the Contractor. This record shall be the property of the Owner.

3.09 WATER/SEWER LINE CROSSING

A. Wherever the sewer crosses above water main with less than a clear vertical separation of 18 inches (outside of pipe to outside of pipe) or below the water main with less than a clear vertical separation of 6 inches (outside of pipe to outside of pipe), the sewer shall be constructed equal to water main pipe. One full pipe length shall be centered on the water main crossing and shall be pressure tested.

B. The type of pipe material and/or joints shall not change between manholes.

3.10 STRUCTURE SEALS

A. Plastic pipe shall be provided with approved water stops where encased in the walls of manholes.

3.11 PIPES TO BE CLEANED

A. The interior of all pipes shall be carefully freed from all dirt, concrete and superfluous material of every description as the work progresses. If, in the opinion of the Engineer, the pipe contains an excess of material, the pipe shall be cleaned by the Contractor at no additional expense to the Owner.

3.12 TESTING

A. General. The following tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall be responsible for providing all labor, materials and equipment for the testing.

B. Deflection Test. All polyvinyl chloride pipe installations shall be tested for deflection by using a rigid ball or mandrel and shall be performed in accordance with ASTM D2321 and without the use of mechanical pulling devices. Deflection may not exceed 5 percent if tested within 30 days of placement of final backfill or 7.5 percent if tested more than 30 days after final backfill is placed. Final backfill must be in place prior to testing.

C. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective work.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Public sanitary utility sewerage pipe shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

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B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.02 PUBLIC SANITARY UTILITY SEWERAGE PIPE

A. Sanitary Sewer, (Material), (Diameter), Lineal Foot. Measurement for Public Sanitary Utility Sewerage Pipe shall be per lineal foot of a specific diameter sewer installed. Payment shall be made at the contract unit price bid per lineal foot of the respective diameter. Contractor shall furnish and install all bedding, fittings, caps, couplings, and appurtenances required to complete the project. All said costs shall be included in the respective sanitary sewer bid items.

B. Sanitary Lateral, (Material), (Diameter), Lineal Foot. Measurement for laterals shall be per lineal foot of a specific size lateral installed. Payment shall be made at the contract unit price bid per lineal foot of each size lateral installed.

END OF SECTION

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SECTION 33 41 13
PUBLIC STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.02 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.03 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications, Latest Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   3. State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition at time of bid opening.

1.04 DESCRIPTION OF WORK

A. The work covered under this section shall consist of furnishing all material, equipment, and labor required to install the public storm utility drainage piping for this project.

1.05 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Structural Excavation for Structures - Division 31

C. Dewatering - Division 31

D. Trenching and Backfilling - Division 31

E. Storm Drainage Manholes, Frames, and Covers - Division 33

1.06 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

PART 2 PRODUCTS AND MATERIALS

2.02 REINFORCED CONCRETE PIPE (RCP)

A. Reinforced concrete pipe shall conform to the requirements of Section 608 of the State of Wisconsin, Department of Transportation, Standard Specifications.

B. Reinforced concrete apron endwalls shall confirm to the requirements of Section 522 of the State of Wisconsin, Department of Transportation, Standard Specifications. All endwalls 24-inches and larger in diameter require trash guard.

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2.03 TRASH GUARDS FOR ENDWALLS

A. Trash guards shall be constructed of painted or galvanized steel bars and pipes, spaced no more than 8-inches on center and welded into the configuration shown on the contract drawings. Fasteners shall be zinc-coated stainless steel.

PART 3 EXECUTION

3.02 GENERAL

A. Construction of the public storm utility drainage piping shall include all excavation, backfilling, compacting of trenches and breaking into existing manholes, inlets or storm sewers required to provide a completed storm sewer at the locations shown on the contract drawings.

3.03 PROTECTION OF EXISTING UTILITIES

A. Utility locations shown on contract drawings are approximate. Contractor shall contact all utility companies at least three working days prior to excavation for locations of all buried utilities owned by them. Should utilities be unexpectedly encountered during excavation, consult Engineer immediately for directions as to procedure. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner. Contractor shall be responsible for the cost of repairing damaged utilities.

3.04 CONCRETE STORM SEWER

A. Concrete storm sewer shall be constructed as shown on the contract drawings and in accordance with Section 608 of the State of Wisconsin, Department of Transportation, Standard Specifications, with the following exceptions and additions:
   1. Joints shall be of flexible watertight rubber gaskets installed as per manufacturer's instructions and in accordance with Section 608 of the State of Wisconsin, Department of Transportation Standard Specifications.
   2. Joints for elliptical storm sewer shall be mortar, gasket, mastic or combination in accordance with Section 608 of the State of Wisconsin, Department of Transportation Standard Specifications.
   3. Backfill shall be as indicated on the contract drawings and specified in Trenching and Backfilling - Division 31 and Special Procedures - Division 01. Backfill shall be incidental to storm sewer construction.
   4. If no embedment class is specified, then Class B embedment with a shaped subgrade shall be used.
   5. Joint ties shall be installed on apron endwall joints and the adjacent two pipe joints.
   6.

3.05 LAYING SEWER PIPE FOR CURVES

A. Sewers laid on curves shall be one of the following types:
   1. Deflection of pipe joints will be permitted when the joint opening is less than 1/2 the length of the tongue for mortar joints or 1/4 the length of the tongue with rubber gasket joints; otherwise use cut-off pipe or miter pipe.
   2. Cut-off pipe shall be molded with the difference between the longest and shortest sides, measured along the outside of the pipe, conforming to the values given in Table 1. Lengths of pipe other than that shown may be used only with approval of the Engineer.
   3. Miter pipe shall be manufactured by the removal of a wedge from the center of the pipe to provide for the required angle of deflection. Sufficient additional reinforcement shall be added at the spring lines and top and bottom of the pipe to prevent shearing after installation. Repairs to complete the pipe shall be such that the concrete shall have the same strength as that of the remainder of the pipe barrel and shall not spall or separate. Miter pipe shall be used for all elliptical pipe laid on a curve. Miter pipe for circular sewers shall be used only with the approval of the Engineer.

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Table 1
Cut-Off of Pipe for Curved Sewer (inches)
(4-foot long pipe sections)

Pipe I.D. Inches	Radius of Curve in Feet							
	40	50	57.3	60	70	80	90	100
21	2-5/8	2-1/8	1-3/4	1-3/4	1-1/2	1-3/8	1-1/4	1/1/8
24	2-7/8	2-3/8	2	2	1-3/4	1/1/2	1-3/8	1-1/4
27	3-1/4	2-5/8	2-1/4	2-1/8	1-7/8	1-5/8	1-1/2	1-3/8
30	3-1/2	2-7/8	2-1/2	2-3/8	2-1/8	1-7/8	1-5/8	1-1/2
36	4-1/4	3-3/8	3	2-7/8	2-1/2	2-1/8	1-7/8	1-3/4
42	--	3-7/8	3-3/8	3-1/4	2-7/8	2-1/2	2-1/4	2
48	--	4-3/8	3-7/8	3-3/4	3-1/4	2-7/8	2-1/2	2-1/4
54	--	--	4-3/8	4-1/8	3-5/8	3-1/8	2-7/8	2-1/2
60	--	--	--	--	4	3-1/2	3-1/8	2-3/4
66	--	--	--	--	4-3/8	3-3/4	3-3/8	3-3/8
72	--	--	--	--	--	4-1/8	3-5/8	3-3/8
78	--	--	--	--	--	4-3/8	4	3-5/8
84	--	--	--	--	--	4-3/4	4-1/4	3-7/8
96	--	--	--	--	--	--	4-7/8	4-3/8

3.06 TESTING

A. Leakage Testing. All storm sewers shall be tested for excessive infiltration and sand leakage. All sand leaks shall be repaired by the Contractor at his expense. If in the judgment of the Engineer the infiltration will cause a continued maintenance problem, the sewer shall be repaired by the Contractor at his expense.

B. Alignment and Grade shall be checked by lamping method to detect poor alignment, offset joints, sags, kinks, or open joints; defects shall be corrected by the Contractor before final acceptance. If closer inspection is warranted, the Owner may arrange for a televised inspection. The Owner will assume the cost of televised inspection if no serious defect is found. If defects are found which the Engineer attributes to the failure of proper installation or sound materials, the Contractor shall pay for the test. Defects shall be promptly corrected.

C. Deflection Limitation. Deflections in corrugated metal pipe shall be limited to 5 percent of the nominal pipe diameter. If visual inspection indicates a greater deflection, the Contractor shall supply and pull a rigid ball or mandrel with a diameter 5 percent less than the nominal pipe size through the sewer. Failure of the ball to freely pass through shall be cause for rejection of the sewer.

D. Deflection Test. All HDPE and PVC pipe installations shall be tested for deflection by using a rigid ball or mandrel and shall be performed in accordance with ASTM D2321 and without the use of mechanical pulling devices. Deflection may not exceed 5 percent if tested within 30 days of placement of final backfill or 7.5 percent if tested more than 30 days after final backfill is placed. Final backfill must be in place prior to testing.

E. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective work.

3.07 PROTECTING OPENINGS

A. Fences shall be provided around all openings and whenever required for the protection of the public. They shall be neat and substantial. All openings, fences, and surface obstructions shall be guarded and shall be indicated at night by suitable flashers.

PART 4 MEASUREMENT AND PAYMENT

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4.02 GENERAL

A. Public storm utility drainage piping shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

4.03 PUBLIC STORM UTILITY DRAINAGE PIPING

A. Public Storm Utility Drainage Piping, Lineal Foot. Measurement for the public storm utility drainage piping shall be for the lineal foot of storm sewer installed, measured to the center of inlets, catch basins and manholes. Payment shall be made at the contract unit price bid per lineal foot of storm sewer installed. Contractor shall furnish and install all bedding, fittings and appurtenances required to complete the project. All said costs shall be included in the respective storm sewer bid items.

B. Apron Endwalls, Each. Measurement for apron endwalls will be for each endwall installed in accordance with the contract drawings and specifications. Endwall will not be included in lineal foot measurement of storm sewer pipe. Payment will be made at the contract price bid per each.

END OF SECTION

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SECTION 40 23 23
PROCESS PIPING, VALVES AND SPECIALTIES

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
   1. American National Standards Institute (ANSI) Standards, Current Edition.
   2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
   3. American Water Works Association (AWWA) Standards, Current Edition.
   4. Commercial Standards (CS) U.S. Department of Commerce Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover the furnishing of all materials, equipment, supervision and labor necessary to install all process piping, valves and specialties. This section shall not apply to electrical conduit or piping for heating and ventilating or plumbing.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals - Division 01

C. High Performance Coatings - Division 09

D. Trenching and Backfilling - Division 31

E. Prepackaged Above Ground Pressure Reducing Station – Division 33

F. Water Utilities – Division 33

G. Prefabricated Booster Pump System - Division 44

1.05 SUBMITTALS

A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 01 of these specifications.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. The manuals shall include operating and maintenance literature for all components provided. The submitted literature shall be in sufficient detail to allow for the installation, operation, adjustment, calibration, maintenance and removal of each component provided.

B. Preparation of this document shall be in conformance with the requirements stated in Submittals - Division 01 of these specifications. The Contractor shall submit to the Engineer for review an outline of any variations of information for the operation and maintenance manuals and other documentation he proposes to prepare.

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PART 2 PRODUCTS AND MATERIALS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer of water processing piping shall have a minimum of 10 years experience in the construction of municipal and industrial piping and appurtenances and shall conform to the required ratings and certifications as indicated.

B. All products specified within this section shall be manufactured in the North America.

2.02 PIPE, GENERAL

A. All piping shall conform to the sizes shown on the contract drawings and shall be of the type and quality as scheduled, unless otherwise designated on the contract drawings.

2.03 PROCESS PIPE

A. Exposed Process Pipe 3 inches and larger
   1. Ductile Iron (DI). Pipe shall meet the requirements of ANSI A21.15 (AWWA C115); Class 53. Joint construction shall be flanged type with required bolts and full-face gasket, meeting the requirements of ANSI A21.11 (AWWA C111). Fittings shall be ductile iron, meeting the requirements of ANSI 21.10 (AWWA C110). Standard cement mortar lining shall meet the requirements of ANSI 21.04 (AWWA C104). All exposed ductile iron pipe shall be factory primed in accordance with High Performance Coatings - Division 09 of these specifications.
   2. Refer to Section 33 12 33 – Prepackaged Ground Pressure Reducing Station for pre-fabricated piping requirements.
   3. Refer to Section 44 42 00.10 Prefabricated Booster Pump System for pre-fabricated skid booster piping requirements.

B. Exposed Process Pipe 2 1/2 inches and smaller
   1. Copper (CU). Pipe shall meet the requirements of ASTM B88, ASTM B585, and ASTM B641 for rigid seamless tubing. The name or trademark of the manufacturer, and type shall be permanently and plainly marked on the pipe at intervals not greater than 1-1/2 feet. Fittings shall be cast brass meeting the requirements of ASTM B62 and ASTM B687 having an alloy composition of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead, having uniformity in wall thickness and strength, and free of any defects. Installation shall be in accordance with governing plumbing codes.

2.04 ZERO LAY LENGTH FLOW METER, MAGMETER (BOOSTER AND PRV STATIONS)

A. Acceptable Manufacturers:
   1. Electromagnetic Sensor:
      a. Endress Hauser Promag W0x DN.
      b. Or Equal.
   2. Signal Converter:
      a. Endress Hauser Proline 400 or better.
      b. Or Equal.

B. Electromagnetic Sensor:
   1. ANSI B 16.5 Class 150, fully rated carbon steel flanges.
   2. Elastomer (chlorobutyl rubber) liner.
   3. Requires No Upstream or Downstream pipe lay lengths for 0.5% accuracy.
   4. Full Bore construction causing no pipe restrictions or pressure loss through meter.
   5. Flush elliptical Hastelloy C electrodes.
   6. Ratings.
      a. Minimum primary rated NEMA 4 (IP67), or as indicated on drawings.
      b. IP 68 with factory potted sensor for below grade installation.
   7. Include two 316 stainless steel grounding rings.
   8. Suitable for process fluid temperature of 150 degrees F.

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9. The sensor shall be rated for installation in hazardous classified space as indicated on drawings.

C. Signal Converter:
1. Remote mounted signal converter rated NEMA 4X (IP65).
2. (2) Isolated 4-20mA active output @ 800 Ohm load.
3. Isolated digital pulse output: active or passive.
4. Low flow cutoff programmable from 1 to 20%.
5. Programmable time constant for pulse and analog outputs from 0.2 to 99 seconds.
6. Minimum accuracy of actual flow of 0.3%
7. Digital signal processing to attenuate flow noise.
8. 115/230 VAC, 48-63 Hz, 8 VA powered.
9. 3-line, LCD display for actual flow rate, flow totalization, programming, and diagnostics.
10. Read-out in gallons/minute for rate and gallons for total.
11. Be fully bi-directional for the display and outputs.
12. Totalize plus flow, minus flow, and sum the difference.
13. Be capable of measuring fluid with up to 5% non-conductive solids by weight without loss of accuracy or response.
14. Have empty pipe zero stabilization.

D. Installation:
1. Provide zero diameters upstream and zero diameters downstream of clear uninterrupted straight pipe the same size as the meter.
2. Manufacturer to provide sufficient double shield signal cable.
3. Wiring by Division 26.

2.05 VALVES

A. Refer to Section 33 12 33 – Prepackaged Above Ground Pressure Reducing Station.

B. Refer to Section 44 42 00.10 – Prefabricated Booster Pump System.

2.06 FLANGE ADAPTERS

A. All flange adapters shall have a minimum working pressure equal to the pipe on which they are installed.

B. Flange adapters shall be Series 2100 Mega-Flange, manufactured by the EBAA Iron Sales, Inc. no substitutions.

C. Flange adapters shall only be installed as shown on the contract drawings or where approved by the Engineer.

2.07 PIPE HANGERS

A. Pipe hangers shall consist of ceiling flange threaded rod, and adjustable clevis type hanger constructed of carbon steel.

2.08 PIPE SUPPORTS

A. Pipe supports shall consist of a base flange, support rod with threaded ends for height adjustment, and a saddle type or stanchion type support as required.

B. Install supports as required to support piping shown on plans; conform to American Standard Code for Pressure Piping, ANSI B31.1. Provide galvanized or stainless structural steel members required for supporting or anchoring piping and accessories.
1. Exterior and underwater pipe supports shall be type 316 stainless teel.
2. Pipe supports in wet atmosphere or corrosive chemical area shall be type 316 stainless steel.
3. Interior room locations not subject to wear or corrosive condition shall have pipe supports of hot-dipped galvanized steel construction.

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2.09 PRESSURE GAUGES

A. Pressure gauges shall be provided to indicate suction and discharge pressure and shall be wall mounted on a steel plate as near to the pressure source as possible. The gauges shall have 4 1/2 inch minimum diameter faces with molded black phenolic case, turret type with snap ring face mounting. The gauge internal construction shall include phosphor bronze bourdon tube with bronze movement. The gauges shall have 1/4" N.P.T. bottom connections, flexible sensing lines, bronze snubbers and needle valves.

B. Pressure gauge ranges for the North Booster Station shall be as follows:
   1. Suction Pressure: -30 to 100 PSI.
   2. Discharge Pressure: 0 to 160 PSI.

C. Pressure gauge ranges for the Pressure Reducing Station shall be as follows:
   1. Primary Zone Pressure: 0 to 100 PSI.
   2. Northeast Zone Pressure: 0 to 100 PSI.

2.10 SAMPLE TAPS

A. Refer to Section 33 12 33 – Prepackaged Above Ground Pressure Reducing Station.

B. Refer to Section 44 42 00.10 – Prefabricated Booster Pump System.

2.11 LABELING AND TAGGING

A. Provide “Non-Potable Water” sign at every non-potable water outlet.

B. Furnish and install adequate marking of exposed accessible process equipment, piping and control devices, per ANSI A13.1.

C. Piping. Painted stencil, or self-adhesive vinyl markers over finished insulation covering. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

D. Submit schedule of identification labels/tags for Engineer approval.

2.12 PAINTING

A. Painting of process piping, valves and specialties shall be in accordance with requirements specified in High Performance Coatings - Division 09 of these specifications.

B. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

PART 3 CONSTRUCTION METHODS

3.01 GENERAL

A. The Mechanical Contractor is responsible for process piping within the limits shown on the contract drawings.

B. All pipe shall be carefully unloaded so it will not be chipped, cracked or have the surface coating damaged. It shall be carefully stored so it is in no way damaged or made unsuitable for its purpose. Pipe shall not be skidded upon the ground. Damaged pipe shall be immediately removed from the work site.

3.02 EQUIPMENT START-UP

A. The pump control valve shall be started by a factory-trained representative who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance. All other equipment shall be started up when installation has been approved as ready for operation. A trained technician shall supervise the startup, make all necessary adjustments and run field tests in the presence of the Engineer.

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3.03 PIPE INSTALLATION

A. Primary line and elevation will be provided by the Engineer. Line and elevation will be established in the field, which, in conjunction with information on the contract drawings, will be sufficient control for the work. The Contractor shall be responsible for preserving the control stakes, marks or nails and if disturbed, shall pay the actual cost of replacement. Notice shall be given one week in advance to give the Engineer enough time to set the control. The Contractor shall transfer line and elevation from the primary control by approved methods. Such methods may vary at different locations to achieve the desired degree of accuracy.

B. Pipes shall be laid with ends abutting and true to line and elevation. Joints shall be full depth or rigidly fixed and located for proper alignment of piping. Pipe suspended or exposed shall be placed at the elevations indicated and supported as shown on the contract drawings. Any work which has been disturbed or which does not conform to line and elevation before final acceptance shall be removed and reconstructed by the Contractor at his expense.

C. Pipes shall be installed with the minimum depth of cover as called for on the contract drawings or as defined in Special Procedures - Division 01 of these specifications.

D. Manufacturer's recommended installation procedures shall be followed.

3.04 PRESSURIZING SYSTEM INSTALLATION

A. Install the water pressurizing system components as indicated on the contract drawings and in accordance with the manufacturer's instructions.

B. Provide and connect piping, valves, accessories and controls as indicated as required to insure a complete, operable system.

3.05 GAUGE INSTALLATION

A. Gauges shall be installed per the manufacturer's recommendations. Gauges shall be tested prior to system start-up to ensure proper operation, which shall include range of motion, lack of oscillations caused by vibration and correct calibration for the installation.

3.06 PERMISSIBLE LEAKAGE

A. Leakage is not permissible on any exposed line or any line that will be placed under pressure or suction. The Contractor shall at his own expense locate and repair the defective joints until the leakage is within the limits described above.

3.07 TESTING

A. General. The following tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall be responsible for providing all labor, materials and equipment for the testing.

B. Pressure Test. All pressure lines shall be tested until successfully meeting the requirements of ANSI A26.00 (AWWA C600), latest edition, for pressure and leakage testing excepting exposed lines which are allowed no leakage. Temporary capping and thrust restraint of open lines will be required for testing.

C. Bacteriological Test. The Contractor shall be responsible for sampling water from process piping after installation. All process piping in contact with potable water shall be tested. All costs for bacteriological testing shall be included in the lump sum bid for the Work. Two "safe" water tests with respect to coliform bacteria shall be obtained at an interval of 24-hours apart and the laboratory reports shall be submitted to the Engineer.

D. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective materials.

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3.08 PIPE HANGERS AND SUPPORTS

A. Piping hangers and their supports shall be sized per the pipe manufacturer's requirements for the process fluid carried, but in no case shall this be less than 3/4 inch wide, 18 gauge steel strap or ring type hangers secured by screw fasteners. Hangers in contact with un-insulated copper tubing or brass piping shall be electrolytically coated and shall be sized accordingly for the outside diameter of the pipe.

B. The location of the hangers and supports shall be coordinated with the structural work to assure that the structural members will support the intended load. In lieu of separate hangers or supports, the Contractor shall submit for approval a detailed drawing of the type of hanger or support he proposes to furnish for handling and supporting multiple pipes.

3.09 HORIZONTAL PIPING

A. Hangers and their supports shall be installed at intervals specified below, at locations not more than 3 feet from ends of each runout and not over 1 foot from each change in direction of piping. Hangers shall be adjustable type. Hangers and supports shall be spaced as follows:
   1. Iron Pipe. Pipe shall be supported near each hub or hubless joint.
   2. Copper Tubing. The maximum spacing between supports shall be as follows:

Normal Pipe Size (In.)	Maximum Span (Ft.)
3/8 thru 3/4	5
1	6
1-1/4	7
1-1/2 and 2	8
2-1/2	9
3	10
4	12

3.10 VERTICAL PIPING

A. Iron vertical piping shall be supported at each floor and at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.

B. Copper vertical tubing shall be bonded at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.

3.11 FIXTURE SUPPORTS

A. Wall hung fixtures, hanger plates, support arms or mounting lugs shall be fastened to the wall by through bolts where appearance of the bolts is not objectionable. Exposed bolt heads in finished areas shall be hexagonal and painted. Exposed nuts shall be chromium plated hexagonal cap nuts. Washers shall be painted or chromium plated to match bolt heads or nuts.

3.12 THRUST RESTRAINTS

A. Provide all pressure pipelines with concrete thrust blocking at all bends, tees, caps, plugs and changes in direction.

B. All bends, tees, caps, plugs and changes in direction under structures shall have both restrained joints and thrust blocks.

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C. Concrete thrust blocks shall be poured against firm, undisturbed ground, with a minimum size as shown on the contract drawings. Where it is not possible to pour thrust blocks against undisturbed ground, thrust blocks shall be poured against backfill compacted to 95 percent modified proctor density. All fittings shall be wrapped in polyethylene prior to placement of concrete thrust blocks. Thrust blocks shall be formed in such a way that joints will be kept free of concrete.

PART 4 MEASUREMENT AND PAYMENT

4.01 PROCESS PIPING, VALVES AND SPECIALTIES

A. General. Process piping, valves and specialties shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

1. Process Piping, Valves and Specialties, Lump Sum. When so provided, payment for process piping, valves and specialties shall be made at the contract lump sum price bid or as specified in Special Procedures - Division 01.
2. Process Piping, Valves and Specialties, Inclusive. When no quantity is provided, process piping, valves and specialties shall be considered inclusive to payment for work scheduled under this contract.

END OF SECTION

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SECTION 44 42 00.10
PREFABRICATED BOOSTER PUMP SYSTEM

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

B. American National Standards Institute (ANSI), Specifications and Standards, Current Edition.

C. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.

D. American Water Works Association (AWWA), Specifications and Standards, Current Edition.

E. National Electrical Manufacturers Associations (NEMA), Specifications and Standards, Current Edition.

F. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.

G. American Welding Society (AWS) Specifications and Standards, Current Edition.

H. National Electric Code (NEC), Specifications and Standards, Current Edition.

I. Steel Structures Painting Council (SSPC), Specifications and Standards, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall cover providing and installing all required equipment and appurtenances for a complete utility package water process booster and control valve system in accordance with the contract drawings and specifications.

B. The work shall furnish and install a factory designed and assembled automatic process package equipment systems with all necessary pumps, internal valves, piping, electrical controls and accessories as shown on the plans and specified herein.

C. The work under this section shall include furnishing and installing:
   1. A factory designed and assembled above grade building with booster pump and flow control valve(s).
   2. Structure 30 – North Booster Station: Install a factory designed and assembled booster pump system. Refer to Section 13 34 30 Fabricated Engineered Structure.

1.04 RELATED WORK ELSEWHERE

A. Procurement and Contracting Requirements - Division 00 (All Sections)

B. Submittals – Division 01

C. High Performance Coatings – Division 09

D. Fabricated Engineered Structure – Division 13

E. Electrical – Division 26

F. Process Piping, Valves, and Specialties – Division 40

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1.05 SUBMITTALS

A. The Contractor shall submit such Submittals and/or catalog cuts required for the construction and installation of the equipment. These drawings shall be accurate in every detail and shall contain all information necessary to relate the equipment to the specifications.

B. The Contractor shall provide a list of all instrumentation and control equipment components to be provided, (only those components required not included in the facility control panel, catalog cuts, and descriptive information for each component.

1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS

A. The manuals shall include operating and maintenance literature for all components provided. The submitted literature shall be in sufficient detail to allow for the installation, operation, adjustment, calibration, maintenance and removal of each component provided.

B. Preparation of this document shall be in conformance with the requirements stated in Submittals - Division 01 of these specifications. The Contractor shall submit to the Engineer for review, an outline of any variations of information for the operation and maintenance manuals and other documentation he proposes to prepare.

PART 2 PRODUCTS AND MATERIALS

2.01 PACKAGE PROCESS WATER SYSTEM

A. The package process water system shall be as manufactured by:
   1. USEMCO, Inc., Tomah, Wisconsin
   2. Or as approved by Engineer.

B. The systems shall be complete with all needed equipment factory installed on a fabricated steel base and enclosed in an insulated modular steel building. Station shall be manufactured by approved manufacturers. Proposed equal equipment must be submitted to the engineer at least 15 days prior to bid. Submittals must include data on all equipment included in the station along with a drawing showing the proposed station. Proposed equal equipment not submitted 15 days prior to the bid date will not be considered.

C. To insure total quality control, the complete unit will be designed, fabricated, assembled and tested in-house by the station manufacturer. The complete pump station will be UL listed under 'QCZJ - Packaged Pumping Systems'. Refer to Section 13 34 30.

2.02 BOOSTER PUMP STATION

A. General
   1. Factory designed and assembled building system: includes booster pumps and valves.

B. Functional Operating Description
   1. Refer to 26 90 00 Process Instrumentation and Control
   2. Refer to Drawings.

C. Equipment Building
   1. Refer to the Drawings.
   2. Refer to Section 13 34 30 Fabricated Engineered Structure.
   3. The station will be complete with a factory assembled modular building affixed to the steel equipment base supporting the booster pumps as shown on the plans. The completed booster station shall be one piece when delivered and require only offloading, installation on the prescribed foundation slab, pipe line hook up and electrical service to complete the installation. Field erected buildings or buildings using steel C studs as wall framing members and C joists as roof trusses will not be acceptable.

D. Lifting Device

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1. Refer to the drawings.
2. Refer to section 13 34 30.

E. Equipment Base
1. Refer to the drawings.
2. Refer to section 13 34 30.
3. Fabricate the equipment chamber's common base from a minimum 3/8" structural grade steel plate, reinforced with adequate sized steel channels to prevent deflection due to equipment weight and stresses imposed from lifting and setting of equipment.
4. Place bolt on lifting eyes on the perimeter of the equipment base to facilitate lifting and handling of the station. The lifting eyes shall be easily removable after the station has been set in place.
5. Insulate the underside of the station base with 3” thick foamed-in-place insulation.
6. The steel plate and structural employed in the base shall meet or exceed the requirement of ASTM-A36.

F. Welding
1. All welding shall be in accordance with standard AWS practices, with proper fillet section and continuity to assure a sound, watertight structure. All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. Butt welds shall be used for all welded joints in line pipe assemblies. Fillet welds shall be used for flange attachment in accordance with AWWA C207. All welds in contact with soil or water shall be tested with a dye penetrant to assure the watertight integrity of the weld system. All pipe and fittings shall be welded by welders certified for ASME type IX pipe welding.

G. Protective Coating
1. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by steel shot blasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding.
2. Steel and cast/ductile iron surfaces shall receive a minimum of two coats of hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products, and salt solutions.
3. The surfaces shall receive two coats a minimum of 4 mils each to a total of 8 mils dry.
4. Piping interior shall have a fusion bonded epoxy coating applied after shot blasting. The coating shall meet AWWA C-213 standards and be applied to a minimum thickness of 12 mils.
5. Paint touch-up kits shall be provided with the station for coating areas damaged in shipping.
6. The floor in all working areas within the station shall be protected with heavy neoprene matting.
7. Refer to specification 09 96 00.
8. Refer to the drawings.
9. Refer to section 13 34 30.

H. Pump Connector
1. Where shown on the drawings, flexible pump connectors shall be provided to relieve strain on the pumps and eliminate transmission of vibration. The body of the connector shall be constructed of multiple layers of neoprene and reinforcement cord. Steel backup flanges with 150# drilling and steel thrust restraints shall be included. The connectors shall be rated for 225 P.S.I.G.

I. Flanged Coupling Adapters
1. Flanged coupling adapters shall be installed in strict accordance with the coupling manufacturer's recommendations. After the pipe is in place and bolted tight, the proper location of holes for the anchor studs shall be determined and the pipe field drilled. Hole diameter shall be not more than 1/8 inch larger than the diameter of the stud projection. Bolted compression couplings shall be provided with harness assemblies.

J. Equipment Space
1. The equipment capsule size as shown on the drawings for this project is appropriate for National Standard mandated clearances and for proper clearances above, below and around equipment to provide for safe servicing, removal and reinstallation of that equipment.

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2. Likewise, the entrance manway and/or equipment hatches shall be sized to provide for the eventual removal and replacement of any component within the station without altering the station to accomplish that task.
3. The drawing for this equipment illustrates clearance/maintenance dimensions about major equipment items. These dimensions are minimum. Dimensions less than those shown "will not" be accepted.

K. Booster Pumps
1. Centrifugal Split-Case Pump
a. The pump end shall be of the centrifugal split-case pump with the motor mounted directly on top of the pump.
b. The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron.
c. Pumps shall be equipped with a high temperature mechanical seal assembly and tungsten carbide/tungsten carbide for pumps.
d. Pumps shall be Goulds 16BF 3x4-8, or approved equal.
e. Design Criteria – Provide pump with the capacity as follows:
1) Pump(s) 1 and 2
2) Number of Pumps: 2
3) Goulds 16BF
4) Design Pt = 500 gpm @ 120 TDH
5) Capacity
a) 200 gpm at 175 feet TDH
b) 300 gpm at 165 feet TDH
c) 400 gpm at 150 feet TDH
d) 500 gpm at 120 feet TDH
e) 600 gpm at 90 feet TDH
6) Speed 3500 rpm
7) VFD compatible
8) HP 25 HP maximum

L. Motor
1. The pump motor shall be solid shaft, TEFC, NEMA Design Inventory Duty ball bearing induction type. The motors shall be Premium Efficiency, with Class F insulation constructed in compliance with NEMA MG1 Part 31, with low starting current and a 1.15 service factor.
2. Motor size shall be sufficient to prevent overloading motor nameplate rating without service factor at all points on the entire pump impeller curve.
3. All motors shall possess the following characteristics:
a. Motors shall be copper wound and suitable for use with 480 volt, three-phase, 60 Hz Power supply.
b. Inverter duty motors with inverter grade motor insulation with extra dips and bakes shall be used on all variable speed pumps.
c. Motors shall be of the horsepower and speed shown in Part 2.02 of this specification section.
d. Motor shall be equipped with temperature switches imbedded in each of the windings and shall be monitored by a single pole / single throw relay for monitoring in SCADA.
e. Refer to Electrical - Division 26 for additional motor requirements.
f. Motors shall be WEG-22 or Baldor Reliance with its series ending in "-G" or "-GS", or approved equal.

M. Pressurizing System
1. Refer to Section 40 23 23 – Process Piping, Valves and Specialties
2. Pipe and Fittings
a. Skid-Mounted Option – Acceptable materials:
1) Schedule 40 black, seamless steel pipe, and shall be manufactured in accordance with A WW A C200 for steel pipe and AWWA C207 for steel butt-welded fittings. Piping shall have fusion bonded epoxy lining in accordance with A WW A C213.
2) Welded Stainless Steel
3) Class 53 Flanged Ductile iron in accordance with Section 40 23 23 specifications.

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b. All piping shall be sized as shown on the contract drawings. Terminate piping with flanged connection compatible with ductile iron pipe.

N. Pressure Reducing Valve (Booster Station)

1. 6" Pressure Reducing Valve (PRV)
   a. Pressure Reducing Valve shall be Model 90-01 as manufactured by Cla-Val.
   b. The valve shall be hydraulically operated, single diaphragm actuated, globe pattern.
      1) Use of flanged pipe reducers or sudden transitions to emulate reduced port properties is not acceptable.
   c. The valve body shall be provided with a solid stainless steel seat and trim.
   d. All wetted parts shall be coated with a high-epoxy primer to a minimum film thickness of 3 mils.
   e. Pressure Class shall be 150 pounds (flanged)
   f. The valve shall be furnished with optional CK2 isolation valves (B)1 and check valves with isolation valve (D)
   g. The valve shall act as a check valve when the pumps are running.
   h. The valve shall act as a pressure reducing valve from the high zone to the primary zone and open at pressure setpoint of 30 psi.

O. Air Release Valves

1. Air Release Valves shall be of the simple lever type and shall be capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure.
2. To assure drop tight shut-off, a viton orifice button shall be used to seal the valve discharge orifice when the valve is in a closed position. The orifice diameter shall be sized for use within a given operating pressure range to ensure maximum discharge capacity.
3. The materials of construction are as follows:
   a. The body and cover shall be of cast iron.
   b. With the exception of the viton orifice button, the leverage mechanism, float and all other internal trim shall be of stainless steel.
4. The stainless steel float shall be designed to and capable of withstanding a pressure in excess of 1,000 psi.
5. The inlet size shall be 1 inch NPT. Provide a 1 inch stainless steel ball valve on the inlet side, and a 180 degrees return bend with screened outlet.
6. The valve shall be Model No. 22, as manufactured by Val-Matic Valve and Manufacturing Corporation, or equal.

P. Check Valve

1. The pump discharge pipe check valve shall be a full body flanged type flexible disc check valves with a domed access cover. Flanges shall be ANSI B16.1, Class 125. The seated surface shall be on a 45 degree angle to minimize disc travel. The top access port shall be full sized to allow removal of the disc without removing the valve from the line.
2. The disc shall be of one piece construction, precision molded with an integral o ring type sealing surface and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for 25 years. Non Slam closing characteristics shall be provided through a short 35 degree disc stroke and a memory disc return action.
3. The valve body shall be constructed of ASTM A126 Class B cast iron. The disc shall be precision molded Buna N, ASTM D2000 BG.
4. A mechanical indicator with pre wired limit switch shall be provided to indicate open/closed valve position to a remote location.
5. The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure. A seat closure test at the valve rating shall be conducted to demonstrate zero leakage.
6. The exterior of the valve shall be coated with a universal alkyd primer. The valve interior shall be coated with an epoxy coating.
7. Pump discharge pipe check valve shall be an 8 inch Model VM 508MI as manufactured by Val Matic Valve & Manufacturing Corporation, Elmhurst, Illinois, or equal.

Q. Butterfly Valves

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1. All butterfly valves shall be lugged style. No wafer style butterfly valves will be permitted in the station.
2. The valve body shall be of cast iron construction with a centering rib to assure accurate positioning. The valve stem shall be of full diameter through the valve body and be isolated from the fluid medium. The valve disc shall be of ductile iron accurately machined for proper contact with the replaceable a seating surface.
3. Valves 6 inches and smaller shall be equipped with lever handles and throttling plates.
4. Valves 8 inches and larger shall be equipped with totally enclosed gear operators with hand wheels with arrow cast in metal to indicate direction of opening.
5. Provide isolation valves on each pump suction and discharge line. Valves shall meet AWWA C504.
6. AWWA Butterfly valves shall be as manufactured by DeZurik, Valmatic, M&H, or equal.
7. Valves more than 8 feet above the floor shall have gear actuator and chain wheel operator.

R. Ball Valves
1. Small Diameter General Purpose Ball Valves
   a. Ball valves, 2 inch and smaller, shall be end entry type, full port, with threaded end connections.
   b. Body shall be full bore 316 stainless steel, two-piece body with vented stainless steel ball and stem.
   c. Seats and seals shall be PTFE.
   d. Provide hand lever operator with stops at the full open and full closed positions.
   e. Valves shall be rated for 400 psi service.
   f. Valves to be Ladish, Apollo, or equal.

S. Sample Taps
1. Sample taps shall be minimum of 1/2" diameter and constructed of no-lead bronze or chrome stainless steel.
2. Bore shall be smooth.
3. NSF 61 approved.

T. Coupling
1. Each pump discharge line shall include a compression type flexible coupling to provide a permanent leak proof flexible connection.

U. Electrical and Controls
1. Refer to Division 26.
2. Refer to the drawings.

2.03 LABELING AND TAGGING

A. Provide “Non-Potable Water” sign at every non-potable water outlet.

B. Furnish and install adequate marking of exposed accessible process equipment, piping and control devices, per ANSI A13.1.

C. Piping. Painted stencil, or self-adhesive vinyl markers over finished insulation covering. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

D. Valves. Minimum diameter plastic engraved tags, 1-1/2 inches. Colors to match system specified in High Performance Coatings - Division 09 of these specifications.

E. Submit schedule of identification labels/tags for Engineer approval.

2.04 MISCELLANEUOS EQUIPMENT

A. Refer to the drawings and Section 13 34 30 for additional information regarding the following equipment:
1. Dehumidifier

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2. Ventilation System
3. Heater

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the skid-mounted booster system in accordance with the manufacturer's recommendations and approved shop drawings.

B. Following installation and connection of all piping, pump and motor shall be checked for alignment in accordance with standards of the Hydraulic Institute.

C. The skid and piping shall be of a modular design such that the largest piece(s) can fit through the 3'-0" wide door opening – see Sheet 30-A101 for door opening dimensions and details.

3.02 FACTORY TEST

A. Prior to assembly, all station components shall be inspected for quality and tested for proper function and be free from defects including, but not limited to, excessive vibration, leaks in piping or seals. Any deficiencies or irregularities shall be corrected at the factory.

B. Skid-Mounted Option – Shall be tested in-house by the station manufacturer.

C. On-Site Installation Option – Shall be tested on-site prior to formal start-up with Owner/Engineer.

3.03 EQUIPMENT START-UP

A. The equipment shall be started by a factory-trained representative who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance.

B. A written report covering the representative's activities and installation approval shall be submitted to the Engineer. This report shall cover all inspections and outline in detail any deficiencies in the installation.

3.04 SYSTEM TEST AND ADJUSTMENT

A. Operate the pump and pressurizing system continuously for a minimum period of 2 hours. Cycle plumbing system outlets to demonstrate proper pump controls and ability of the equipment to maintain system pressure within the specified operating range. Demonstrate system pressure relief setting. Make necessary adjustments in accordance with the manufacturer's instructions.

B. In the event a component fails to perform as specified or is proven defective during operation, correct all deficiencies and retest. Testing shall be conducted in the presence of and to the satisfaction of the Engineer.

3.05 WIRING

A. All wiring shall comply with the National Electric Code and applicable state and local codes. Wiring shall be completely factory installed except for the power lines that run to the control panel continuously from the external disconnect switch.

B. All wiring within the equipment chamber and outside the control panel shall be run in PVC rigid conduit except for the liquid tight metallic flexible conduit to connect the pump motors. Accessory items such as the sump pump, dehumidifier, etc. with approved manufacturer's rubber cord may be plugged into polarized grounded outlets.

C. It shall be the responsibility of the local electrical contractor to furnish and install correctly sized service wires from the service pole outside the equipment chamber to the control panel. It shall also be the responsibility

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of the electrical contractor to furnish and install, if required, any exterior disconnects or switching mechanisms.

3.06 INSPECTION AND TEST

A. Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

3.07 INITIAL OPERATION

A. After the job installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Four (4) copies of O and M manuals will be supplied to the owner prior to initial operation.

3.08 GUARANTEE

A. The manufacturer of the pump station shall guarantee for a period of one year from the date station is placed into operation or eighteen months from date of shipment, whichever occurs first, that the entire station and all equipment therein shall be free from defects in design, materials and workmanship. In the event a component fails or is proven defective during the guarantee period, the manufacturer will provide a replacement part without cost, upon return of the defective part. Normal use items, such as grease, light bulbs, mechanical seals, packing and belts are excluded.

PART 4 MEASUREMENT AND PAYMENT

4.01 PREFABRICATED BOOSTER PUMP SYSTEM

A. General. Potable water system shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures - Division 01.

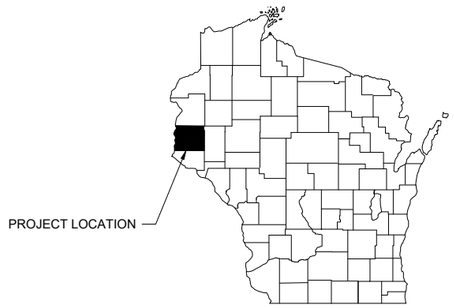
1. Prefabricated Booster Pump System, Inclusive. When no quantity is provided, potable water system shall be considered inclusive to payment for work associated with wastewater process piping system

END OF SECTION

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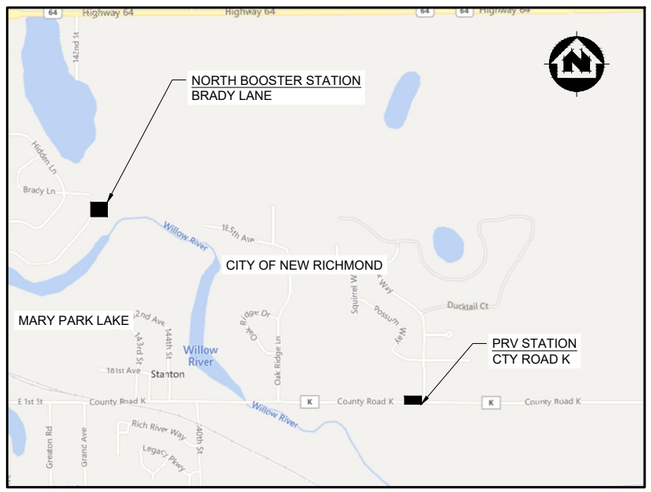
BOOSTER STATION AND PRV STATION

CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN



CITY OF NEW RICHMOND
THE CITY BEAUTIFUL

PLANS PREPARED ON BEHALF OF THE
CITY OF NEW RICHMOND, WISCONSIN



LOCATION MAP
NOT TO SCALE

QR CODE MAP LINKS

PRESSURE REDUCING VALVE STATION

NORTH BOOSTER STATION

CIVIL LEGEND

W	EXISTING WATER MAIN
	EXISTING WATER MAIN, VALVE & HYDRANT
	EXISTING WATER SERVICE & CURB STOP
	PROPOSED WATER MAIN, VALVE, & HYDRANT
	PROPOSED WATER SERVICE & CURB STOP
SAN	EXISTING SANITARY SEWER & MANHOLE
	PROPOSED SANITARY SEWER & MANHOLE
FM	EXISTING FORCEMAIN
SS	EXISTING STORM SEWER & INLET
	PROPOSED STORM SEWER & INLET
	PROPOSED STORM SEWER & MANHOLE
E	BURIED ELECTRIC
G	BURIED GAS & VALVE
TV	BURIED CABLE TELEVISION
T	BURIED TELEPHONE
FO	BURIED FIBER OPTICS
OH	OVERHEAD UTILITY
	RAILROAD TRACKS
	EXISTING CURB & GUTTER
	PROPOSED CURB & GUTTER
	EXISTING SIDEWALK
	PROPOSED SIDEWALK
CP	EXISTING CULVERT PIPE
	PROPOSED CULVERT PIPE
	FENCE LINE
	DRAINAGE ARROW
	SILT FENCE
	RIGHT-OF-WAY
	BASELINE
	PROPERTY LINE
	TREE LINE
	BENCHMARK
	IRON PIPE
	IRON ROD
	CONTROL POINT
	UTILITY POLE & GUY
1 000,00	SOIL BORING
	LIGHT POLE
	PEDESTAL
	STREET SIGN
	MAILBOX
	FLAGPOLE
	TREE - DECIDUOUS
	TREE - CONIFEROUS
	TREE TO BE REMOVED

UTILITY CONTACTS

NATURAL GAS:
XCEL ENERGY
ATTN: CATHY SCHANTNER
2426 7TH AVENUE
OSCEOLA, WI 54020
PH: (715) 737-1102

ELECTRIC:
NEW RICHMOND UTILITIES
ATTN: WESTON ARNDT, SUPERINTENDENT
156 E 1ST STREET
NEW RICHMOND, WI 54017
EMAIL: WARNDT@NEWRICHMONDWI.GOV
PH: (715) 246-4167

SEWER & WATER:
NEW RICHMOND UTILITIES
ATTN: DAVID PUFALL, SUPERINTENDENT
156 E 1ST STREET
NEW RICHMOND, WI 54017
EMAIL: NRUWATER@NEWRICHMONDWI.GOV
PH: (715) 246-4167

CATV/FIBER:
NORTHWEST COMMUNICATIONS
116 HARRIMAN AVENUE
AMERY, WI 54001
PH: (715) 268-7101

PHONE/INTERNET:
FRONTIER COMMUNICATIONS
154 E 2ND STREET
NEW RICHMOND, WI 54017
PH: (715) 243-7004

WISCONSIN
LANCE E. TEUNISSEN
43365
SHEBOYGAN
WI
PROFESSIONAL ENGINEER
Lance Teunissen
11/18/2025

ELECTRICAL

WISCONSIN
ANDREW T. ROCKWEILER
E-47341
REEDSBURG, WI
PROFESSIONAL ENGINEER
11-18-25

GENERAL/CIVIL/PROCESS

WISCONSIN
SERENA H. GILLES
E-46901-6
MADISON
WI
PROFESSIONAL ENGINEER
11/18/2025

STRUCTURAL (BOOSTER STATION FOUNDATION)

DIGGERS HOTLINE
Dial 811 or (800) 242-8511
www.DiggersHotline.com

NOTE:
UTILITY LOCATIONS SHOWN ON PLANS ARE APPROXIMATE AND CONTRACTOR SHALL HAVE APPROPRIATE UTILITY MARK EXACT LOCATIONS PRIOR TO CONSTRUCTION.

NO.	DATE	REVISION	BY

PROJECT DATE: NOVEMBER 18, 2025
DRAWN BY: JJY
DESIGNED BY: ATR
CHECKED BY: EE

PLOT DATE: 11/18/2025 1:44 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Title Sheet.dwg

MSA
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

GENERAL
TITLE SHEET

PROJECT NO. 07985049.2
SHEET 00-G001

DISCIPLINE IDENTIFICATION & SHEET ORDER

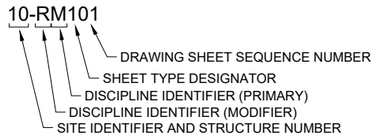
DESIGNATION	DISCIPLINE
G	GENERAL
R	REMOVAL/DEMOLITION
C	SITE CIVIL
L	LANDSCAPE
S	STRUCTURAL
A	ARCHITECTURAL
M	PROCESS MECHANICAL
P	PLUMBING
H	HVAC
E	ELECTRICAL
O	OPERATIONS
F	FIRE

NOTE: FOR CLARITY, PORTIONS OF THE WORK FOR A DISCIPLINE MAY BE SHOWN ON A SHEET WITH DIFFERENT DISCIPLINE DESIGNATION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO COORDINATE THE WORK OF ALL DISCIPLINES SO THAT ALL WORK IS COMPLETED AS SHOWN, FOR A COMPLETE AND OPERABLE SYSTEM.

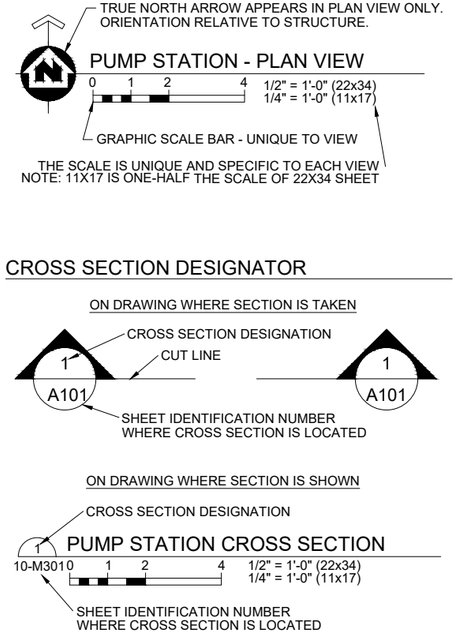
SHEET TYPE DESIGNATOR

DESIGNATOR	SHEET TYPE
0	GENERAL
1	PLANS
2	ELEVATIONS (EXTERIOR)
3	SECTIONS
4	LARGE-SCALE VIEWS
5	DETAILS
6	SCHEDULES & DIAGRAMS
7	NOT USED
8	NOT USED
9	ISOMETRICS

SHEET IDENTIFICATION NUMBERING EXAMPLE



PLAN VIEW LABEL



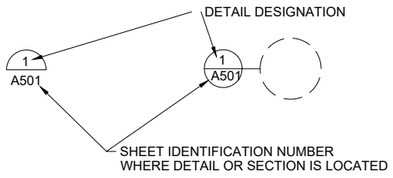
CROSS SECTION DESIGNATOR

ON DRAWING WHERE SECTION IS TAKEN

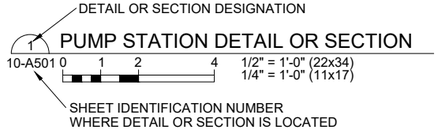
ON DRAWING WHERE SECTION IS SHOWN

DETAIL OR SECTION DESIGNATOR

ON DRAWING WHERE SECTION IS TAKEN



ON DRAWING WHERE SECTION IS SHOWN



SHEET INDEX

00 - GENERAL SHEETS

00-G001	TITLE SHEET
00-G002	SHEET IDENTIFIERS AND INDEX
00-G003	ELECTRICAL SYMBOLS AND ABBREVIATIONS
00-G004	ELECTRICAL SYMBOLS AND ABBREVIATIONS
00-G005	ELECTRICAL SYMBOLS AND ABBREVIATIONS

05 - CIVIL DETAILS

05-C501	EROSION CONTROL DETAILS
05-C502	EROSION CONTROL DETAILS
05-C503	WATER MAIN DETAILS
05-C504	STORM & SANITARY SEWER DETAILS
05-C505	STREET DETAILS
05-C506	TRAFFIC CONTROL DETAILS

06 - PROCESS INTEGRATION

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06-N602	P&ID NO.2
06-N603	SCADA SYSTEM NETWORK ARCHITECTURE

07 - ELECTRICAL ONE-LINES

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07-E602	ONE-LINE

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20-C101	SITE, UTILITY, AND GRADING PLAN
20-C102	TEMPORARY TRAFFIC CONTROL PLAN
20-C103	EROSION CONTROL PLAN
20-CE101	ELECTRICAL SITE PLAN
20-M101	PROCESS PLAN
20-M501	PROCESS DETAILS

30 - NORTH BOOSTER STATION

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30-C102	UTILITY PLAN
30-C103	EROSION CONTROL PLAN
30-C501	GENERATOR EQUIPMENT PAD DETAIL
30-CE101	ELECTRICAL SITE PLAN
30-S001	STRUCTURAL SCHEDULES AND GENERAL NOTES
30-S101	FOUNDATION PLAN
30-S501	STRUCTURAL DETAILS
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30-A201	EXTERIOR ELEVATIONS
30-A501	ARCHITECTURAL DETAILS
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30-M102	PROCESS FLOOR PLAN
30-M301	PREFABRICATED BUILDING SECTION
30-M302	PREFABRICATED BUILDING SECTIONS
30-M501	PROCESS DETAILS
30-M901	PROCESS ISOMETRICS
30-E101	ELECTRICAL PLANS

99 - ELECTRICAL SCHEDULES

99-E501	ELECTRICAL DETAILS
99-E502	ELECTRICAL DETAILS
99-E601	PANEL & FIXTURE & FIXTURE SCHEDULES
99-E602	WIRING SCHEDULES
99-E603	I-O SCHEDULES

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

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1230 South Boulevard, Baraboo WI 53913
(608) 356-2771 www.msa-ps.com

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

GENERAL
SHEET IDENTIFIERS AND INDEX

PROJECT NO. 07985049.2
SHEET 00-G002

GENERAL NOTES:

1. THIS DRAWING IS A STANDARD LEGEND. SYMBOLS SHOWN MAY NOT ALL APPEAR ON DRAWINGS FOR THIS PROJECT.
2. ALL CONTACTS ARE SHOWN IN THE DE-ENERGIZED (SHELF) POSITION. BI-STABLE RELAYS ARE SHOWN IN THE RESET POSITION.
3. ONE-LINE DIAGRAMS FOR POWER SWITCHGEAR, USE ANSI STANDARD SYMBOLS AND ABBREVIATIONS.
4. SEE INSTRUMENTATION DRAWINGS FOR INSTRUMENTATION SYMBOLS AND DETAILS.
5. OTHER ABBREVIATIONS PER ANSI Z32.13 AND ISA S5.1
6. ELEVATIONS ADJACENT TO SYMBOLS ARE BASED ON STATION DATUM. HEIGHTS ADJACENT TO SYMBOLS (+4.0) ARE REFERENCED TO FINISHED FLOOR GRADE.
7. THE LETTERS "GFI" ADJACENT TO A RECEPTACLE INDICATES A GROUND FAULT INTERRUPTER FEED-THROUGH RECEPTACLE ASSEMBLY. THE LETTERS ADJACENT TO A PANELBOARD CIRCUIT BREAKER INDICATES A GROUND FAULT CIRCUIT BREAKER. THE LETTERS "IG" INDICATE AN ISOLATED GROUND RECEPTACLE, PROVIDE SEPARATE GROUND WIRE.
8. SEE SPECIFICATIONS AND SCHEDULES FOR COMPONENT REQUIREMENTS FOR MOTOR CONTROLLERS AND FOR CONTACTORS.
9. EXISTING PROCESS EQUIPMENT, ELECTRICAL EQUIPMENT, CONTROL DEVICES AND INSTRUMENTATION TO REMAIN WILL BE SHOWN AS HALF-TONE ON MOTOR CONTROL CENTER ONE-LINES AND PROCESS PIPING & INSTRUMENTATION DIAGRAMS.
10. EXISTING PROCESS EQUIPMENT, ELECTRICAL EQUIPMENT, CONTROL DEVICES AND INSTRUMENTATION TO REMAIN AND BE MODIFIED (RELOCATED, RE-WIRED, ETC.) WILL BE SHOWN AS FULL-TONE ON THE PROCESS PIPING & INSTRUMENTATION DIAGRAMS. REFER TO DRAWING NOTES AND CONTRACTUAL PROVISION REQUIREMENTS (P).

ELECTRICAL ABBREVIATIONS

AFD	ADJUSTABLE FREQUENCY DRIVE	EM	EMERGENCY	KVA	KILOVOLT-AMPERES	PC	PHOTO CONTROL
AFG	ABOVE FINISH GRADE	EP	CLASS 1, DIV. 1 EQUIPMENT	KW	KILOWATTS	PFR	PHASE FAIL RELAY
AHU	AIR HANDLING UNIT	EUH	ELECTRIC UNIT HEATER	MAU	MAKE-UP AIR UNIT	PVC	POLYVINYL CHLORIDE
AUTO	AUTOMATIC	EWC	ELECTRIC WATER COOLER	M.C.	MECHANICAL CONTRACTOR	REQ'D	REQUIRED
AUX	AUXILIARY	EWH	ELECTRIC WALL HEATER	MCC	MOTOR CONTROL CENTER	SPEC	SPECIFICATION
AWG	AMERICAN WIRE GAUGE	FBO	FURNISHED BY OTHERS	MFR	MANUFACTURER	SPD	160KA/PHASE MINIMUM SURGE PROTECTIVE DEVICE
BKR	BREAKER	G	GROUND	MS-AUX	MOTOR STARTER AUXIULIARY	SS	STAINLESS STEEL
C	CONDUIT	G.C.	GENERAL CONTRACTOR	mA	MILLIAMPERE	TC	7 DAY TIMECLOCK PROVIDED BY ELECTRICAL CONTRACTOR
CB	CIRCUIT BREAKER	GFI	GROUND FAULT INTERRUPTER	mV	MILLIVOLT	TYP	TYPICAL
CKT	CIRCUIT	GND	GROUND	MOD	MOTOR OPERATED DAMPER	UH	UNIT HEATER
CU	COPPER	HVAC	HEATING, VENTILATING & AIR CONDITIONING	NL	NIGHTLIGHT	UPS	UNINTERRUPTIBLE POWER SUPPLY
DISC	DISCONNECT	HTR	HEATER	N.O.	NORMALLY OPEN	W/	WITH
E.C.	ELECTRICAL CONTRACTOR	I.S.	INTRINSICALLY SAFE	N.C.	NORMALLY CLOSED	WH	WATER HEATER
ECB	ENCLOSED CIRCUIT BREAKER	I/O	INPUT/OUTPUT	NF	NON-FUSED	WP	WEATHER PROOF
EDH	ELECTRIC DUCT HEATER	IG	ISOLATED GROUND	NTS	NOT TO SCALE	XFMR	TRANSFORMER
EF	EXHAUST FAN	J-BOX	JUNCTION BOX	O.L.	OVERLOAD	XLP	CROSS LINKED POLYETHYLENE
ELEV	ELEVATION	KCMIL	THOUSAND CIRCULAR MILS	OHD	OVER HEAD DOOR		
		KV	KILOVOLTS				

ELECTRICAL PLAN SYMBOLS

- S — SINGLE POLE SWITCH, 2=2-POLE, 3=3 WAY, 4=4 WAY, P=PILOT R=RELAY, K=KEYED, I=ILLUMINATED, D=DIMMER M=MOTION X.P. = EXPLOSION PROOF
- SIMPLEX RECEPTACLE, GFI = GROUND FAULT CIRCUIT INTERRUPTER, WP = WEATHERPOROOF, XP=EXPLOSION PROOF,CW = CLOTHES WASHER, DW = DISCHWASHER, REF = REFRIGERATOR, = FREEZER, MIC = MICROWAVE
- DUPLEX RECEPTACLE GFI = GROUND FAULT CIRCUIT INTERRUPTER, WP = WEATHERPOROOF, XP=EXPLOSION PROOF,CW = CLOTHES WASHER, DW = DISCHWASHER, REF = REFRIGERATOR, = FREEZER, MIC = MICROWAVE
- DUPLEX RECEPTACLE, 42" ABOVE FINISHED FLOOR
- DUPLEX RECEPTACLE, HALF SWITCHED
- POWER RECEPTACLE 240V 30=30AMP 60=60AMP R = 50A RANGE OUTLET D = 30A DRYER OUTLET
- DUPLEX RECEPTACLE MOUNTED ABOVE COUNTER
- DUAL SERVICE FLOOR BOX, REFER TO DRAWINGS FOR REQUIREMENTS
- SINGLE SERVICE FLOOR BOX, REFER TO DRAWINGS FOR REQUIREMENTS
- POKE THROUGH FLOOR BOX, REFER TO DRAWINGS FOR REQUIREMENTS
- WIREMOLD PLUG STRIP
- EQUIPMENT CONNECTION
- SPECIAL OUTLET
- EQUIPMENT CONNECTION HOMERUN, SEE SPECIFIC PLAN FOR CIRCUIT
- DISCONNECT SWITCH, SEE SPECIFIC KEYNOTES. F = FUSED
- MS — MANUAL STARTER
- MOTOR CONNECTION
- J — J-BOX, SIZE AND TYPE AS NOTED
- LIGHT FIXTURE, CEILING MOUNTED, FLUSH OR SURFACE MOUNTED. REFER TO FIXTURE SCHEDULE
- LIGHT FIXTURE, CEILING MOUNTED, FLUSH OR SURFACE MOUNTED. REFER TO FIXTURE SCHEDULE
- LIGHT FIXTURE, WALL MOUNTED, FLUSH OR SURFACE. REFER TO FIXTURE SCHEDULE
- EMERGENCY LIGHT, WALL MOUNTED. REFER TO FIXTURE SCHEDULE.
- REMOTE EMERGENCY LIGHT, WALL MOUNTED. REFER TO FIXTURE SCHEDULE.
- EXIT LIGHT - ONE FACE, ARROWS IF SHOWN INDICATE DIRECTION TO EXIT. — WALL MOUNTED. NO LINES REPRESENT CEILING MOUNTED, TYPICAL ALL EXITS
- EXIT LIGHT - ONE FACE WITH EMERGENCY HEADS. ARROWS IF SHOWN INDICATE DIRECTION TO EXIT.
- EXIT LIGHT - TWO FACE. ARROWS IF SHOWN INDICATE DIRECTION TO EXIT.
- LIGHT FIXTURE, POLE MOUNTED, REFER TO SCHEDULE
- PC — PHOTOCELL

- DUAL TECHNOLOGY OCCUPANCY SENSOR, WALL MOUNTED WALL MOUNTED — WALL MOUNTED. NO LINES REPRESENT CEILING MOUNTED, TYPICAL.
- MULTI DIRECTION DUAL TECHNOLOGY OCCUPANCY SENSOR
- X — CEILING OCCUPANCY SENSOR WHERE X = TYPE. U = ULTRASONIC, L = LONG THROW, HB = HIGH BAY
- x — DATA OUTLET, X = NUMBER OF PORTS WHEN GREATER THAN 1.
- x — TELEPHONE OUTLET, X = NUMBER OF PORTS WHEN GREATER THAN 1.
- COMBINATION TELEPHONE/DATA OUTLET.
- WAP — WIRELESS ACCESS POINT
- TV — COAX OUTLET
- AI — 2 WAY INTERCOM SYSTEM DOOR STATION
- AM — 2 WAY INTERCOM SYSTEM MASTER STATION
- AO — AUTOMATIC DOOR OPENER
- CA — COMBINATION CARD ACCESS CARD READER PAD
- CR — CARD READER
- DC — DOOR POSITION SWITCH CONTACT
- DP — DOOR POSITION SWITCH
- DS — DOOR STRIKE
- EL — ELECTRIC TRIM LATCH
- KP — KEY PAD
- LS — LIMIT SWITCH
- M — SECURITY SYSTEM MOTION DETECTOR CEILING MOUNTED 360°
- M — SECURITY SYSTEM MOTION DETECTOR - WALL MOUNTED
- ML — MAGNETIC LOCK
- RX — REQUEST TO EXIT
- SECURITY CAMERA - DIRECTIONAL — WALL MOUNTED. NO LINES REPRESENT CEILING MOUNTED (TYPICAL)
- SECURITY CAMERA - 90°
- SECURITY CAMERA - 180°
- SECURITY CAMERA - 270°
- SECURITY CAMERA - 360°

PROCESS PIPING AND INSTRUMENEATION DIAGRAM SYMBOLS

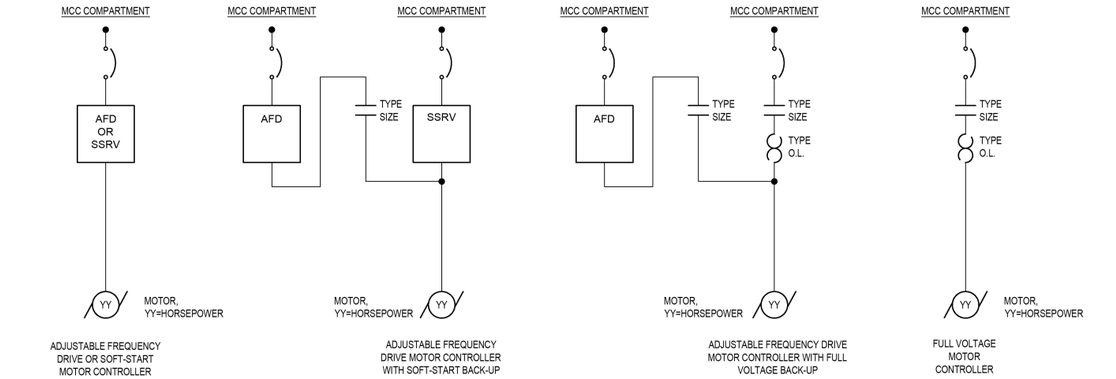
- FIELD MOUNTED INSTRUMENT OR CONTROL DEVICE
- PRIMARY FRONT-OF-PANEL MOUNTED INSTRUMENT OR CONTROL DEVICE
- PRIMARY BACK-OF-PANEL MOUNTED INSTRUMENT OR CONTROL DEVICE
- AUXILIARY FRONT-OF-PANEL MOUNTED INSTRUMENT OR CONTROL DEVICE
- AUXILIARY BACK-OF-PANEL MOUNTED INSTRUMENT OR CONTROL DEVICE
- NORMALLY ACCESSIBLE SCADA/HMI SYSTEM FUNCTION
- NOT NORMALLY ACCESSIBLE SCADA/HMI SYSTEM FUNCTION
- SCADA ALARM NOTIFICATION SYSTEM ALARM FUNCTION
- I — INTERLOCK FUNCTION, REFER TO SPECIFICATIONS
- RACK MOUNTED CONTROLLER INPUT/OUTPUT POINT (PLC OR PLC RACK I-O, ETC.)
- REMOTE MOUNTED NETWORK DEVICE INPUT/OUTPUT POINT (AFD, O.L., ETC.)

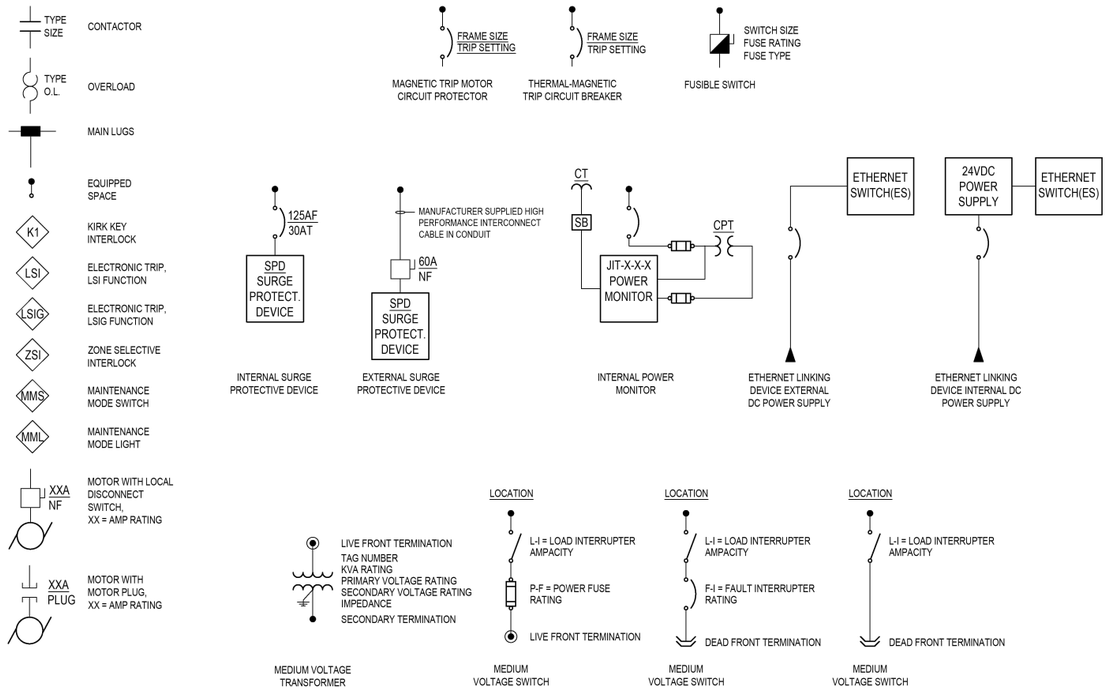
NOTE: REFER TO INSTRUMENTATION AND CONTROL DEVICE SYMBOL LEGEND FOR DESCRIPTORS AND CONTRACTUAL PROVISIONAL REQUIREMENTS.

- MS / XX — FULL VOLTAGE MOTOR CONTROLLER, XX INDICATES LOCATION
- XX / YY — MOTOR CONTROLLER, XX INDICATES TYPE OF CONTROLLER WHERE SSRV = REDUCED VOLTAGE SOFT STARTER AND AFD = ADJUSTABLE FREQUENCY DRIVE. YY INDICATES LOCATION, FOR EXAMPLE 10-MCC-001.

- FIRE ALARM PANEL OR SUPPORT ITEM. FACP = FIRE ALARM CONTROL PANEL, FAAP = FIRE ALARM ANNUNCIATOR PANEL, FAPS - FIRE ALARM POWER SUPPLY, FACC = FIRE ALARM COMMAND CENTER, RTS = REMOTE TEST SWITCH
- X — WALL MOUNTED AUDIO (HORN) / VISUAL NOTIFICATION APPLIANCE, X = CANDELLA LEVEL
- X — WALL MOUNTED AUDIO (VOICE) / VISUAL NOTIFICATION APPLIANCE, X = CANDELLA LEVEL; WALL MOUNTED FIRE ALARM SPEAKER
- SX — WALL MOUNTED VISUAL NOTIFICATION APPLIANCE, X = CANDELLA LEVEL
- X — CEILING MOUNTED AUDIO (HORN) / VISUAL NOTIFICATION APPLIANCE, X = CANDELLA LEVEL
- X — CEILING MOUNTED AUDIO (VOICE) /VISUAL NOTIFICATION APPLIANCE, X = CANDELLA LEVEL; CEILING MOUNTED FIRE ALARM SPEAKER
- SX — CEILING MOUNTED VISUAL NOTIFICATION, X = CANDELLA LEVEL APPLIANCE
- F — WALL MOUNTED AUDIO (HORN) NOTIFICATION APPLIANCE
- B — WALL MOUNTED BELL
- DOOR HOLDER. M = MAGNETIC, EH = ELECTRIC
- CM — ADDRESSABLE CONTROL MODULE
- F — MANUAL PULL STATION
- DETECTOR, H = HEAT, S = SMOKE, CM = CARBON MONOXIDE, DS = DUCT SMOKE, ES = ELEVATOR SMOKE
- S — SMOKE DETECTOR WITH SOUNDER BASE
- FS — SPRINKLER FLOW SWITCH
- PS — SPRINKLER PRESSURE SWITCH
- TS — SPRINKLER TAMPER SWITCH
- ADDRESSABLE MONITOR MODULE
- ARS — AREA OF REFUGE (CALL BOX) / TWO-WAY COMMUNICATION SYSTEM
- ARM — AREA OF REFUGE MASTER (BASE STATION) / TWO-WAY COMMUNICATION SYSTEM
- TWC — TWO-WAY COMMUNICATION (CALL BOX)
- TWCM — TWO-WAY COMMUNICATION MASTER (BASE STATION)

MOTOR CONTROL CENTER (MCC) SYMBOLS





PROCESS INSTRUMENTATION, EQUIPMENT, AND PROCESS VALVE ELECTRICAL INSTALLATION AND WIRING SCHEDULE WIRE LEGEND

ANALOG SIGNAL	Ax = 2C#16 SHIELDED TWISTED PAIR CABLE, WHERE x = NUMBER OF CABLES. PROVIDE IN CONDUIT(S) AS REQUIRED TO NOT EXCEED SPECIFIED MAXIMUM CONDUIT FILL, MINIMUM SIZE 3/4".
DISCRETE SIGNAL	Dx = #14 THHN WIRE, WHERE x = NUMBER OF WIRES. PROVIDE IN CONDUIT(S) AS REQUIRED TO NOT EXCEED SPECIFIED MAXIMUM CONDUIT FILL, MINIMUM SIZE 3/4".
MANUFACTURER'S SIGNAL	Mx = CONDUIT FOR CABLE SUPPLIED BY MANUFACTURER, WHERE x = NUMBER OF CONDUITS. MINIMUM 3/4" CONDUIT SIZE OR LARGER AS REQUIRED TO NOT EXCEED SPECIFIED MAXIMUM CONDUIT FILL.
ETHERNET SIGNAL	Ex = CAT6 CABLE, WHERE x = NUMBER OF CABLES. PROVIDE IN CONDUIT(S) AS REQUIRED TO NOT EXCEED SPECIFIED MAXIMUM CONDUIT FILL, MINIMUM SIZE 3/4".

PROCESS NOTES:

1. SIZE CONDUIT PER NEC. MINIMUM SIZE 3/4".
2. PROVIDE SEPARATE CONDUITS FOR THE FOLLOWING:
   a. 4-20mADC
   b. 120 VOLT CONTROL
   c. 120 VOLT POWER
   d. 480 VOLT POWER
   e. LOW VOLTAGE INSTRUMENTATION
   f. COMMUNICATION
3. REFER TO SPECIFICATION 26 90 00 FOR DETAILS ON VARIOUS LOOP FUNCTIONS AS WELL AS DETAILS REGARDING OPERATOR INTERFACE FUNCTIONS.
4. REFER TO DIVISION SPECIFICATIONS FOR ADDITIONAL DETAILS REGARDING INSTRUMENTATION AND CONTROL EQUIPMENT FURNISHED UNDER THOSE SPECIFICATIONS.

WIRING & CONDUIT

1. (X) #12 & #12G
   REFERS TO NUMBER OF WIRE(S) AND SIZE OF WIRE(S) REQUIRED, WHERE AS:
   (1) = ONE WIRE
   #12 = THE SIZE OF WIRE REQUIRED
   G = GROUND WIRE
2. (X) 1-1/2"C
   REFERS TO NUMBER OF CONDUIT(S) AND SIZE OF CONDUIT(S) REQUIRED, WHERE AS:
   (1) = ONE CONDUIT
   1-1/2"C = THE SIZE OF CONDUIT REQUIRED

REFER TO DRAWINGS FOR REQUIRED WIRE AND CONDUIT SIZES AND QUANTITIES.

PLOT DATE: 11/18/2025 5:06:22 PM — J:\Autodesk Docs\07985049 - New Richmond Water Tower #3 and Booster Station Design\07985049_ELECTRICAL MODEL_R24.rvt

PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: AMS	No	DATE	REVISIONS	BY
	DESIGNED BY: AMS				
	CHECKED BY: LET				

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(608) 356-2771 www.msa-ps.com

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

ELECTRICAL SYMBOLS AND ABBREVIATIONS

PROJECT NO. 07985049.2
SHEET 00-G003

EQUIPMENT / DEVICE TAG NAMING AND ADDITIONAL DESCRIPTOR CONVENTIONS

COMMON NOTATIONS (WHERE REFERENCED UNDER TAG CATEGORY)

ADDITIONAL DESCRIPTORS:

- P = CONTRACTUAL PROVISION REQUIREMENTS (ONLY IDENTIFIED ON CONSTRUCTION CONTRACT DRAWINGS) WHERE:
  - (BLANK) = EQUIPMENT PROVIDED UNDER DIVISION 26, REFER TO SPECIFICATIONS
  - * = EXISTING EQUIPMENT WITH WORK REQUIRED
  - ** = EQUIPMENT PROVIDED UNDER ANOTHER DIVISION
  - *** = SPECIAL CONDITION, REFER TO NOTES
- C = ATMOSPHERE (REFER TO SPACE CLASSIFICATION ON PLANS RATING REQUIREMENTS) / INSTALLATION REQUIREMENTS FOR ELECTRICALLY POWERED EQUIPMENT WHERE:
  - (BLANK) = NON-RATED ATMOSPHERE / NORMAL INSTALLATION REQUIREMENTS
  - i.s. = HAZARDOUS LOCATION ATMOSPHERE / INTRINSICALLY SAFE INSTALLATION REQUIREMENTS
  - x.p. = HAZARDOUS LOCATION ATMOSPHERE / EXPLOSION PROOF INSTALLATION REQUIREMENTS

AUTOMATICALLY OPERATED VALVES AND GATES

TAG NAMING:

- T = FLUID ABBREVIATION WHERE:
  - A = AIR
  - C = CHEMICAL
  - F = FUEL
  - L = LIQUID
  - S = SOLIDS
  - W = WATER (TREATED, NON-POTABLE, OR POTABLE)
- U = CONTROL TYPE WHERE:
  - C = AUTOMATICALLY CONTROLLED
- V = ELEMENT TYPE WHERE:
  - V = VALVE
  - G = GATE
- W = UNIT PROCESS NUMBER
- X = LOOP NUMBER
- Y = UNIT NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X DESIGNATION
- Z = SET NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X-Y DESIGNATION

ADDITIONAL DESCRIPTORS:

- A = NOMINAL PIPE SIZE
- B = VALVE OR GATE TYPE, REFER TO SPECIFICATIONS
- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)
- C = ATMOSPHERE/INSTALLATION REQUIREMENTS FOR ELECTRICALLY POWERED EQUIPMENT (SEE COMMON NOTATIONS)
- D = ACTUATOR TYPE OR SERVICE WHERE::
  - (BLANK) = MANUAL
  - M = MODULATING
  - O/C = OPEN/CLOSE

EQUIPMENT

TAG NAMING:

- T = EQUIPMENT IDENTIFIER
- W = UNIT PROCESS NUMBER
- X = LOOP NUMBER
- Y = UNIT NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X DESIGNATION

ADDITIONAL DESCRIPTORS:

- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)
- C = ATMOSPHERE/INSTALLATION REQUIREMENTS FOR ELECTRICALLY POWERED EQUIPMENT (SEE COMMON NOTATIONS)
- NAME = DESCRIPTIVE EQUIPMENT NAME

PROCESS LINES

TAG NAMING:

- X = NOMINAL PIPE DIAMETER IN INCHES, (BLANK) INDICATES OPEN CONDUIT
- Y = FLOW STREAM IDENTIFIER FROM "FLOW STREAM ABBREVIATION TABLE"
- Z = UNIT PROCESS NUMBER (WHERE NOTED)
- AA = UNIT PROCESS FLOW STREAM NUMBER (WHERE NOTED)
- BB = FLOW STREAM ROUTE NUMBER (WHERE NOTED)
- CC = FLOW STREAM ROUTE SEGMENT NUMBER (WHERE NOTED)

PROCESS LINE LINKS

ADDITIONAL DESCRIPTORS:

- W = UNIT PROCESS NUMBER
- A = INTERFACE LETTER
- TO = DESTINATION DRAWING
- FROM = SOURCE DRAWING
- D = DESCRIPTIVE TEXT

VESSELS, STRUCTURES, AND TANKS

TAG NAMING:

- T = EQUIPMENT IDENTIFIER
- W = UNIT PROCESS NUMBER
- X = LOOP NUMBER
- Y = UNIT NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X DESIGNATION

ADDITIONAL DESCRIPTORS:

- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)
- NAME = DESCRIPTIVE EQUIPMENT NAME

MANUALLY OPERATED VALVES AND GATES

TAG NAMING:

- T = FLUID ABBREVIATION WHERE:
  - A = AIR
  - C = CHEMICAL
  - F = FUEL
  - L = LIQUID
  - S = SOLIDS
  - W = WATER (TREATED, NON-POTABLE, OR POTABLE)
- U = CONTROL TYPE WHERE:
  - (BLANK) = MANUALLY CONTROLLED
- V = ELEMENT TYPE WHERE:
  - V = VALVE
  - G = GATE
- W = UNIT PROCESS NUMBER
- X = LOOP NUMBER
- Y = UNIT NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X DESIGNATION
- Z = SET NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X-Y DESIGNATION

ADDITIONAL DESCRIPTORS:

- A = NOMINAL PIPE SIZE
- B = VALVE TYPE, REFER TO SPECIFICATIONS
- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)

INSTRUMENTATION & CONTROL DEVICES

TAG NAMING:

- T = FIRST LETTER FROM "INSTRUMENT SOCIETY OF AMERICA INSTRUMENT DEFINITION TABLE"
- UV = SUCCEEDING LETTERS FROM "INSTRUMENT SOCIETY OF AMERICA INSTRUMENT DEFINITION TABLE"
- W = UNIT PROCESS NUMBER
- X = LOOP NUMBER
- Y = UNIT NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X DESIGNATION
- Z = SET NUMBER, USED FOR MULTIPLE DEVICES WITH THE SAME W-X-Y DESIGNATION

ADDITIONAL DESCRIPTORS:

- A = NUMBER OF UNITS DEPICTED (Y VARIES WITH ASSOCIATED EQUIPMENT OR DEVICE UNIT NUMBER)
- B = NUMBER OF SETS DEPICTED, ONLY IDENTIFIED IF NECESSARY (Z VARIES FROM 1 TO B)
- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)
- C = ATMOSPHERE/INSTALLATION REQUIREMENTS FOR ELECTRICALLY POWERED EQUIPMENT (SEE COMMON NOTATIONS) / EXPLOSION PROOF INSTALLATION REQUIREMENTS
- D = SUPPLEMENTAL DESCRIPTION, REFER TO ABBREVIATIONS
- XX = CONTROL SYSTEM INPUT/OUTPUT TYPE WHERE:
  - DI = DISCRETE INPUT
  - DO = DISCRETE OUTPUT
  - AI = ANALOG INPUT
  - AO = ANALOG OUTPUT
- YY = NUMBER OF POINTS DEPICTED, REFER TO I-O SCHEDULES

CONTROL PANELS

TAG NAMING:

- T = FIRST INDENTIFIER WHERE:
  - (BLANK) = LOCAL CONTROL PANEL
  - XXX = SCADA SYSTEM PLC CONTROL PANEL LOCATION STRUCTURE NUMBER
- UV = SECOND IDENTIFIER WHERE
  - LCP = LOCAL CONTROL PANEL
  - PLC = SCADA SYSTEM PLC CONTROL PANEL
- W = UNIT PROCESS NUMBER FOR LOCAL CONTROL PANELS
- X = LOOP NUMBER FOR LOCAL CONTROL PANELS
- Y = UNIT NUMBER FOR LOCAL CONTROL PANELS OR SCADA SYSTEM PLC CONTROL PANELS

ADDITIONAL DESCRIPTORS:

- P = CONTRACTUAL PROVISION REQUIREMENTS (SEE COMMON NOTATIONS)

PROCESS FLOW STREAM IDENTIFICATION

AIR

- AA = PROCESS AIR, ATMOSPHERIC
- CA = PROCESS AIR, CONTROL
- PALP = PROCESS AIR, LOW PRESSURE
- PAHP = PROCESS AIR, HIGH PRESSURE
- SA = PROCESS AIR, SERVICE

CHEMICAL

- APHC = ACIDIC PH CONTROL
- CLG = CHLORINATION GAS
- CLS = CHLORINATION SOLUTION
- CPHC = CAUSTIC PH CONTROL
- DCLG = DECHLORINATION GAS
- DCLS = DECHLORINATION SOLUTION
- NRC = NITROGEN REMOVAL CARBON
- PRF = PHOSPHORUS REMOVAL FLOCCULANT
- PRC = PHOSPHORUS REMOVAL COAGULANT
- STF = SLUDGE THICKENING FLOCCULANT
- SDF = SLUDGE DEWATERING FLOCCULANT

FUEL AND OIL

- BG = BIOGAS (DIGESTER GAS)
- DFS = DIESEL FUEL SUPPLY
- DFR = DIESEL FUEL RETURN
- FO = FUEL OIL
- HO = HYDRAULIC OIL
- LPL = LIQUEFIED PETROLEUM LIQUID
- LPG = LIQUEFIED PETROLEUM GAS
- LO = LUBRICATION OIL
- NG = NATURAL GAS
- TOS = THERMAL OIL SUPPLY
- TOR = THERMAL OIL RETURN

SOLIDS

- CKS = SLOPPY DRIED SLUDGE CAKE
- DDS = DEWATERED DIGESTED SLUDGE
- DS = DIGESTED SLUDGE
- DSC = DRIED SLUDGE CAKE
- GR = GRIT
- PSD = PRIMARY SLUDGE
- PSM = PRIMARY SCUM
- RAS = RETURN ACTIVATED SLUDGE
- SCR = SCREENINGS
- SP = SEPTAGE
- SSM = SECONDARY SCUM
- TDS = THICKENED DIGESTED SLUDGE
- TPSD = THICKENED PRIMARY SLUDGE
- TWAS = THICKENED WASTE ACTIVATED SLUDGE
- WAS = WASTE ACTIVATED SLUDGE

WATER

- W1 = POTABLE WATER, PROTECTED
- W2 = POTABLE WATER, UNPROTECTED
- W3 = NON-POTABLE WATER

WASTE

- CEN = CENTRATE
- DCT = DECANT
- EFR = EXCESS FLOW RETURN
- FBW = FILTER BACKWASH
- FCE = FINAL CLARIFIER EFFLUENT
- FE = FILTER EFFLUENT
- FI = PUMPED FILTER INFLUENT
- FIL = FILTRATE
- GR/R = GRIT RETURN
- INFL = WASTEWATER, INFLUENT
- ML = MIXED LIQUOR
- PCE = PRIMARY CLARIFIER EFFLUENT
- PCI = PRIMARY CLARIFIER INFLUENT
- PLE = PLANT EFFLUENT
- RWW = WASTEWATER, PRIOR TO HEADWORKS
- SAN = SANITARY
- SCE = SECONDARY CLARIFIER EFFLUENT
- SCR/R = SCREENINGS RETURN
- SPN = SUPERNATANT
- SS = SIDESTREAMS
- XX/D = PROCESS DRAIN, XX=FLOW STREAM
- XX/OF = PROCESS OVERFLOW, XX=FLOW STREAM
- XX/S = PROCESS SAMPLE, XX=FLOW STREAM
- XX/V = PROCESS VENT, XX=FLOW STREAM

NOTES:

1. THIS IS A COMPREHENSIVE SYMBOL AND ABBREVIATION LEGEND AND AS SUCH, MAY DEPICT SYMBOLS AND ABBREVIATIONS THAT ARE NOT APPLICABLE TO THIS PROJECT.
2. PROCESS PIPING AND VALVES SHOWN ON P&IDS ARE INTENDED TO COMPLIMENT OTHER DRAWINGS. ADDITIONAL PROCESS DETAILS AND ACCESSORIES MAY BE DEPICTED ON OTHER DRAWINGS.
3. REFER TO "EQUIPMENT / DEVICE TAG NAMING AND ADDITIONAL DESCRIPTOR CONVENTIONS" FOR DEFINITION OF THE NOTATIONS SHOWN ON:
   - 3.1. "INSTRUMENTATION AND CONTROL DEVICE SYMBOL LEGEND"
   - 3.2. "PROCESS AND SIGNAL LINE LINK LEGEND"
   - 3.3. "LINE AND EQUIPMENT TAG LEGEND"

INSTRUMENT SOCIETY OF AMERICA INSTRUMENT DEFINITION TABLE

LETTER	FIRST LETTER		SUCCEEDING LETTERS		
	PROCESS OR INITIATING VARIABLE	VARIABLE MODIFIER	READOUT/PASSIVE FUNCTION	OUTPUT/ACTIVE FUNCTION	FUNCTION MODIFIER
A	ANALYSIS (+)		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE (+)	USER'S CHOICE (+)	USER'S CHOICE (+)
C	CONDUCTIVITY			CONTROL	
D	DENSITY	DIFFERENTIAL			DEVIATION
E	VOLTAGE		SENSOR OR PRIMARY ELEMENT		
F	FLOW	RATIO (FRACTION)			
G	USER'S CHOICE (+)		GLASS OR VIEWING DEVICE	GATE	
H	HAND (MANUAL)			HIGH	HIGH
I	CURRENT		!NDICATE		
J	POWER		SCAN		
K	TIME OR SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (STATUS INDICATION)	LOW	LOW
M	MOISTURE				MIDDLE OR INTERMEDIATE
N	TORQUE		USER'S CHOICE (+)	USER'S CHOICE (+)	USER'S CHOICE (+)
O	USER'S CHOICE (+)		ORIFICE OR RESTRICTION		OPEN
P	PRESSURE (OR VACUUM)		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT (+)	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE (+)		MULTIFUNCTION (+)	MULTIFUNCTION (+)	MULTIFUNCTION (+)
V	VISCOSITY, VIBRATION, OR MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL OR PROBE		
X	USER'S CHOICE (+)	X AXIS	ACCESSORY DEVICES	UNCLASSIFIED (+)	UNCLASSIFIED (+)
Y	EVENT STATE (+)	Y AXIS		RELAY OR COMPUTE	
Z	POSITION	Z AXIS		DRIVE, ACTUATE, OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(+) EXPLANATION IS INDICATED AS DESCRIPTOR ADJACENT TO INSTRUMENT SYMBOL. REFER TO ABBREVIATIONS OR SYMBOLS ON LEGEND FOR ADDITIONAL INFORMATION.

INSTRUMENTATION AND CONTROL DEVICE SYMBOL LEGEND

DEVICE LOCATION \ DEVICE TYPE	INSTRUMENT OR CONTROL DEVICE FIELD MOUNTED	INSTRUMENT OR CONTROL DEVICE FRONT-OF-PANEL MOUNTED	INSTRUMENT OR CONTROL DEVICE BACK-OF-PANEL MOUNTED	PILOT INDICATING DEVICE FRONT-OF-PANEL MOUNTED	SCADA / HMI SYSTEM FUNCTION NORMALLY ACCESSIBLE	SCADA / HMI SYSTEM FUNCTION NOT NORMALLY ACCESSIBLE	SCADA ALARM NOTIFICATION SYSTEM ALARM CONDITION	INPUT / OUTPUT POINT CONTROLLER RACK-MOUNTED DEVICE	INPUT / OUTPUT POINT REMOTE-MOUNTED NETWORK DEVICE
FIELD	P TUV W-X-Y-Z D C (A)(B)								
PRIMARY SCADA SYSTEM OR OTHER LOCAL (FIELD) CONTROL PANEL		P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z (A)(B)	XX (YY)	XX (YY)
AUXILIARY MOTOR CONTROL CENTER OR OTHER LOCAL (FIELD) MOTOR CONTROL PANEL		P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z D (A)(B)	P TUV W-X-Y-Z (A)(B)	XX (YY)	XX (YY)

PROCESS AND SIGNAL LINE LINK LEGEND

- W-A TO — PROCESS LINE LINK WITH A MATCHING LINK DEPICTED ON ANOTHER P&ID IN THIS SET OF CONTRACT DRAWINGS
- FROM W-A
- W-A — PROCESS LINE LINK WITH A MATCHING LINK DEPICTED ON ANOTHER P&ID IN THAT IS NOT INCLUDED IN THIS SET OF CONTRACT DRAWINGS
- W-A
- D — PROCESS LINE LINK TO AN EXTERNAL PROCESS
- D
- W-A TO — SIGNAL LINE LINK WITH A MATCHING LINK DEPICTED ON ANOTHER P&ID IN THIS SET OF CONTRACT DRAWINGS
- FROM W-A

LINE AND EQUIPMENT TAG LEGEND

- X-Y — PROCESS LINE TAG OPTION 1
- Y — PROCESS LINE TAG OPTION 2
- X-Y-Z-AABBCC — PROCESS LINE TAG OPTION 3
- NAME T-W-X-Y P C — EQUIPMENT TAG
- TUV-W-X-Y-Z P C A D B — AUTOMATICALLY OPERATED VALVE TAG
- TUV-W-X-Y-Z A B P — MANUALLY OPERATED VALVE TAG
- T-W-X-Y NAME P — TANK, VESSEL, OR STRUCTURE TAG
- T-UV-W-X-Y P NAME — CONTROL PANEL TAG

SIGNAL LINE LEGEND

NEW		EXISTING
—o—	DIGITAL	—o—
- - - - - -	DISCRETE	- - - - - -
- -A- - -	ANALOG	- -A- - -
- -PF- - -	PULSE/FREQUENCY	- -PF- - -
- -M- - -	MANUFACTURER	- -M- - -
//	PNEUMATIC	//
X	CAPILLARY	X

PARALLEL SIGNAL LINES

DESCRIPTION (A) — DESCRIPTION (B)(C)

WHERE:
DESCRIPTION = AN ABBREVIATED IDENTIFICATION OF THE SIGNALS DEPICTED
A = TOTAL QUANTITY OF SIGNALS
B = QUANTITY OF TYPICAL SETS OF SIGNALS
C = QUANTITY OF SIGNALS IN EACH TYPICAL SET

PROCESS LINE LEGEND

NEW		EXISTING
	PRIMARY MAJOR	
	SECONDARY MAJOR	
	PRIMARY MINOR	
	SECONDARY MINOR	

CONNECTING LINES — NON-CONNECTING LINES

PLOT DATE: 11/18/2025 5:06:23 PM — J:\Autodesk Docs\07985049 - New Richmond Water Tower #3 and Booster Station Design\07985049_ELECTRICAL MODEL_R24.rvt

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1230 SOUTH BOULEVARD, BARABOO WI 53913
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

ELECTRICAL SYMBOLS AND ABBREVIATIONS

PROJECT NO. 07985049.2
SHEET 00-G004

PROCESS VALVE AND GATE SYMBOLS

PROCESS VALVES

GENERAL PURPOSE VALVES

- PLUG VALVE
- BUTTERFLY VALVE
- GATE VALVE
- KNIFE GATE VALVE
- BALL VALVE
- VEE BALL VALVE
- GLOBE VALVE
- DIAPHRAGM VALVE
- NEEDLE VALVE
- PINCH VALVE
- ROTARY VALVE
- TELESCOPING VALVE
- MUD VALVE

CHECK VALVES

- SWING CHECK VALVE
- BALL CHECK VALVE
- DOUBLE LEAF CHECK VALVE
- DUCKBILL CHECK VALVE
- FOOT VALVE

PRESSURE CONTROL VALVES

- PRESSURE REGULATING VALVE, SELF-SENSING
- PRESSURE REGULATING VALVE, EXTERNAL-SENSING
- PRESSURE REDUCING VALVE, SELF-SENSING
- PRESSURE REDUCING VALVE, EXTERNAL-SENSING
- PRESSURE RELIEF VALVE
- PRESSURE RELIEF VALVE (ATMOSPHERIC)
- VACUUM RELIEF VALVE (ATMOSPHERIC)

SPECIAL PURPOSE VALVES

- CIRCUIT SETTER VALVE
- BALANCING VALVE
- DAMPER
- BALANCING DAMPER
- QUICK ACTING VALVE
- FUSIBLE LINK VALVE
- BACKFLOW PREVENTER

MULTI-PORT GENERIC VALVES

- ANGLE VALVE
- 3-WAY VALVE
- 4-WAY VALVE

SYMBOL DEPICTS A GENERIC VALVE TYPE, REFER TO VALVE SPECIFICATION TYPE FOR VALVE DETAILS

PROCESS GATES

- FABRICATED SLIDE GATE
- BUTTERFLY GATE
- SLUICE GATE
- FLAP GATE
- STOP LOG
- SHEAR GATE

PROCESS VALVE AND GATE ACTUATORS

- E — ELECTRIC MOTOR ACTUATED VALVE
- H — HYDRAULICALLY ACTUATED VALVE
- P — PNEUMATICALLY ACTUATED VALVE
- S — SOLENOID ACTUATED VALVE
- E — ELECTRIC MOTOR ACTUATED GATE
- H — HYDRAULICALLY ACTUATED GATE
- P — PNEUMATICALLY ACTUATED GATE

NOTES:

1. SYMBOLS DEPICT GATE VALVES AND FABRICATED SLIDE GATES AS EXAMPLES, REFER TO P&IDS FOR ACTUAL VALVE AND GATE TYPE.
2. REFER TO TAG DESCRIPTIONS FOR ACTUATOR DETAILS SUCH AS "OPEN/CLOSE" OR "MODULATING" SERVICE.

FITTINGS AND COMPONENTS

IN-LINE FITTINGS AND COMPONENTS

- EXPANSION JOINT
- FLANGED COUPLING ADAPTER
- DISMANTLING JOINT
- DRESSER COUPLING
- Y-STRAINER
- Y-STRAINER W/ DRAIN VALVE
- BASKET STRAINER
- LIQUID FILTER
- GAS FILTER
- SUCTION DIFFUSER
- C.O. — CLEANOUT
- UNION

MISCELLANEOUS FITTINGS / COMPONENTS

- Y-TRAP, FLOOR DRAIN, OR AIR GAP
- P-TRAP
- PIPE CAP
- HOSE CONNECTION
- FLEXIBLE HOSE
- BLIND FLANGE
- PIPE FLARE
- SPRAY BALL

REDUCERS

- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- CONCENTRIC FLEXIBLE REDUCER
- ECCCENTRIC FLEXIBLE REDUCER

AIR FITTINGS AND COMPONENTS

- SILENCER, AIR SERVICE
- FILTER, AIR SERVICE
- FINE BUBBLE DIFFUSER
- COARSE BUBBLE DIFFUSER
- GAS CYLINDER

OTHER FITTINGS AND COMPONENTS

- DRYER, AIR SERVICE
- AFTER COOLER, AIR SERVICE
- CONTAINMENT OR CARRIER PIPE
- HEAT TRACE
- EDUCTOR
- STATIC MIXER

CHEMICAL FEED SYSTEMS

- LIQUID CHEMICAL DRUM
- CHEMICAL INJECTION RING
- LIQUID CHEMICAL TANK
- CHEMICAL TANK WITH HEAT BLANKET

PUMPS

- SUBMERSIBLE PUMP
- SUBMERSIBLE AXIAL PROPELLOR PUMP
- POSITIVE DISPLACEMENT PROGRESSIVE CAVITY PUMP
- DRY PIT SUBMERSIBLE PUMP
- DRY PIT PUMP
- POSITIVE DISPLACEMENT ROTARY LOBE PUMP
- POSITIVE DISPLACEMENT GEAR PUMP
- SUBMERSIBLE SOLIDS HANDLING PUMP
- DRY PIT SELF-PRIMING SOLIDS HANDLING PUMP
- POSITIVE DISPLACEMENT PISTON PUMP
- POSITIVE DISPLACEMENT PLUNGER PUMP
- DRY PIT SUBMERSIBLE SOLIDS HANDLING PUMP
- DRY PIT SOLIDS HANDLING PUMP
- HOSE PUMP
- AIR OPERATED DOUBLE DIAPHRAGM PUMP
- SUBMERSIBLE CHOPPER PUMP
- DRY PIT RECESSED IMPELLER PUMP
- DRY PIT SUBMERSIBLE CHOPPER PUMP
- DRY PIT CHOPPER PUMP
- SCREW PUMP
- POSITIVE DISPLACEMENT DOUBLE DISC PUMP
- AIR OPERATED SINGLE DIAPHRAGM PUMP
- VERTICAL TURBINE PUMP
- SOLIDS HANDLING VERTICAL TURBINE PUMP
- HORIZONTAL SPLIT-CASE PUMP
- SUBMERSIBLE WELL PUMP
- PERISTALTIC CHEMICAL METERING PUMP
- DIAPHRAGM CHEMICAL METERING PUMP, ADJUSTABLE SPEED CONTROLLER
- DIAPHRAGM CHEMICAL METERING PUMP, ADJUSTABLE STROKE LENGTH

BLOWERS AND COMPRESSORS

- REGENERATIVE BLOWER
- MULTI-STAGE CENTRIFUGAL BLOWER
- TURBO BLOWER
- SCREW BLOWER
- ROTARY LOBE POSITIVE DISPLACEMENT BLOWER
- MULTI-STAGE CENTRIFUGAL COMPRESSOR
- TURBO COMPRESSOR
- SCREW COMPRESSOR
- PISTON COMPRESSOR

CONVEYANCE

- SCREW CONVEYOR
- BELT CONVEYOR

PROCESS INSTRUMENTATION SYMBOLS

- FLOAT SWITCH
- LEVEL SENSOR SUBMERSIBLE -DIAPHRAGM
- LEVEL SENSOR SUBMERSIBLE -BULLET
- LEVEL SENSOR UTLRASONIC
- LEVEL SENSOR RADAR
- LEVEL SENSOR RADAR GUIDED WAVE
- BUBBLE TUBE
- GENERIC INSTRUMENT
- OPEN CHANNEL PARSHALL FLUME
- OPEN CHANNEL PALMER-BOWLUS FLUME
- OPEN CHANNEL TRAPEZOIDAL FLUME
- RECTANGULAR WEIR
- V-NOTCH WEIR
- TRAPEZOIDAL WEIR
- BENDING WEIR
- D — DRAIN
- FLOW TUBE MAGNETIC
- FLOW TUBE PROPELLOR
- FLOW TUBE ORIFICE PLATE
- FLOW TUBE VENTURI
- ROTAMETER
- PRESSURE SEAL DIAPHRAGM
- PRESSURE SEAL ANNULAR
- S — SAMPLE TAP
- F — FLUSHING TAP

TREATMENT MIXING

- DISC AERATOR
- PROPELLER MIXER
- AGITATION MIXER

SCREENING AND GRIT

- GRIT CLASSIFIER
- GRIT CLASSIFIER
- VERTICAL FINE SCREEN
- STAIR SCREEN
- INCLINED FINE SCREEN
- SCREENINGS WASH PRESS
- SCREENINGS WASH PRESS

SOLIDS HANDLING/DIGESTER

- GENERIC HEAT EXCHANGER
- PLATE FRAME HEAT EXCHANGER
- BOILER HEAT EXCHANGER
- SHELL TUBE HEAT EXCHANGER

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1230 SOUTH BOULEVARD, BARABOO WI 53913
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
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ELECTRICAL SYMBOLS AND ABBREVIATIONS

PROJECT NO. 07985049.2
SHEET 00-G005

CONSTRUCTION SITE
EROSION CONTROL REQUIREMENTS

1. SECTION NR216.46 OF WISCONSIN STATE ADMINISTRATIVE CODE IDENTIFIES REQUIREMENTS FOR CONSTRUCTION SITE AND POST-CONSTRUCTION EROSION CONTROL. IT IS THE INTENT OF THESE PLANS TO SATISFY THESE REQUIREMENTS. THE METHODS AND STRUCTURES USED TO CONTROL EROSION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. CONTRACTOR SHALL IMPLEMENT AN APPROPRIATE MEANS OF CONTROLLING EROSION DURING SITE OPERATION AND UNTIL THE VEGETATION IS RE-ESTABLISHED. ADJUSTMENTS TO THE CONTROL SYSTEM SHALL BE MADE AS REQUIRED.
2. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE WISCONSIN DNR'S CONSERVATION PRACTICE STANDARDS. THESE STANDARDS ARE PERIODICALLY UPDATED AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN AND REFERENCE THE MOST RECENTLY RELEASED STANDARD.
3. THIS INFORMATION IS ONLY ONE PART OF THE OVERALL EROSION CONTROL REQUIREMENTS. ADDITIONAL REQUIREMENTS MAY ALSO BE SHOWN ON THE CONTRACT DRAWINGS AND IN THE ACCOMPANYING SPECIFICATIONS.
4. ADDITIONAL EROSION CONTROL MEASURES, AS REQUESTED IN WRITING BY THE STATE OR LOCAL INSPECTORS, OR THE OWNER'S ENGINEER, SHALL BE INSTALLED WITHIN 24 HOURS.
5. THE AREA OF EROSIVE LAND EXPOSED TO THE ELEMENTS BY GRUBBING, EXCAVATION, TRENCHING, BORROW AND FILL OPERATIONS AT ANY ONE TIME SHALL BE MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE. FOR ANY DISTURBED AREA THAT REMAINS INACTIVE FOR GREATER THAN 7 WORKING DAYS, OR WHERE GRADING WORK EXTENDS BEYOND THE PERMANENT SEEDING DEADLINES, THE SITE MUST BE TREATED WITH TEMPORARY STABILIZATION MEASURES SUCH AS SOIL TREATMENT, TEMPORARY SEEDING AND/OR MULCHING. ALL DISTURBED AREAS SHALL BE TREATED WITH PERMANENT STABILIZATION MEASURES WITHIN 3 WORKING DAYS OF FINAL GRADING.
6. ALL EROSION CONTROL MEASURES AND STRUCTURES SERVING THE SITE MUST BE INSPECTED AT LEAST WEEKLY OR WITHIN 24 HOURS OF THE TIME 0.5 INCHES OF RAIN HAS OCCURRED. ALL NECESSARY REPAIR AND MAINTENANCE WILL BE DONE AT THIS INSPECTION TIME.
7. ALL EROSION CONTROL DEVICES AND/OR STRUCTURES SHALL BE PROPERLY INSTALLED PRIOR TO CLEARING AND GRUBBING OPERATIONS WITHIN THEIR RESPECTIVE DRAINAGE AREAS. THESE SHALL BE PROPERLY MAINTAINED FOR MAXIMUM EFFECTIVENESS UNTIL VEGETATION IS RE-ESTABLISHED.
8. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY INSTALLED PRIOR TO ANY SOIL DISTURBANCE.
9. ANY SLOPES STEEPER THAN 3H:1V SHALL BE STAKED WITH EROSION CONTROL FABRIC UNLESS INDICATED ON THE PLAN.
10. ALL WASTE AND UNUSED BUILDING MATERIALS (INCLUDING GARBAGE, DEBRIS, CLEANING WASTES, WASTEWATER, TOXIC MATERIALS, OR HAZARDOUS MATERIALS) SHALL BE PROPERLY DISPOSED OF AND NOT ALLOWED TO BE CARRIED OFF-SITE BY RUNOFF OR WIND.
11. WIND EROSION SHALL BE KEPT TO A MINIMUM DURING CONSTRUCTION. WATERING, MULCH, OR A TACKING AGENT MAY BE REQUIRED TO PROTECT NEARBY RESIDENCES AND WATER RESOURCES.
12. CHANNELIZED RUNOFF ENTERING THE PROJECT SITE FROM ADJOINING LANDS SHALL BE DIVERTED THROUGH NATURALLY OR ARTIFICIALLY EROSION-RESISTANT CONVEYANCES. IF CHANNELIZED RUNOFF CANNOT BE DIVERTED, SITE BEST MANAGEMENT PRACTICES MUST ACCOUNT FOR THE ADDITIONAL FLOW RATES AND EROSION POTENTIAL THAT SUCH RUNOFF PRESENTS.
13. THE CONTRACTOR SHALL TAKE ALL POSSIBLE PRECAUTIONS TO PREVENT SOILS FROM BEING TRACKED ONTO PUBLIC OR PRIVATE ROADWAYS. PAVED SURFACES ADJACENT TO CONSTRUCTION SITE VEHICLE ACCESS SHALL BE SWEPT AND/OR SCRAPED (NOT FLUSHED) PERIODICALLY TO REMOVE SOIL, DIRT, AND/OR DUST.
14. EROSION CONTROLS SHALL BE INSTALLED ON THE DOWNSTREAM SIDE OF TEMPORARY STOCKPILES. ANY SOIL STOCKPILE THAT REMAINS FOR MORE THAN 30 DAYS SHALL BE COVERED OR TREATED WITH STABILIZATION PRACTICES SUCH AS TEMPORARY OR PERMANENT SEEDING AND MULCHING. ALL STOCK PILES SHALL BE PLACED AT LEAST 75 FEET FROM STREAMS OR WETLANDS.
15. ADDITIONAL EROSION CONTROL FOR UTILITY CONSTRUCTION (STORM SEWER, SANITARY SEWER, WATER MAIN, ETC.) SHALL INCLUDE THE FOLLOWING:
    a. PLACE EXCAVATED TRENCH MATERIAL ON THE HIGH SIDE OF THE TRENCH.
    b. BACKFILL, COMPACT, AND STABILIZE THE TRENCH IMMEDIATELY AFTER PIPE CONSTRUCTION.
    c. DISCHARGE OF TRENCH WATER OR DEWATERING EFFLUENT MUST BE PROPERLY TREATED TO REMOVE SEDIMENT IN ACCORDANCE WITH THE WDNR CONSERVATION PRACTICE STANDARD 1061 - DEWATERING OR A SUBSEQUENT WDNR DEWATERING STANDARD PRIOR TO DISCHARGE INTO A STORM SEWER, DITCH, DRAINAGEWAY, OR WETLAND OR LAKE.
16. ALL DRAINAGE CULVERTS, STORM DRAIN INLETS, MANHOLES, OR ANY OTHER EXISTING STRUCTURES THAT COULD BE DAMAGED BY SEDIMENTATION SHALL BE PROTECTED ACCORDING TO THE VARIOUS METHODS PROVIDED IN THE PRINTED CONSERVATION PRACTICE STANDARDS.
17. ANY SOIL EROSION THAT OCCURS AFTER FINAL GRADING AND/OR STABILIZATION MUST BE REPAIRED AND THE STABILIZATION WORK REDONE.
18. THE FIRST SIX WEEKS AFTER INITIAL STABILIZATION, ALL NEWLY SEEDED AND MULCHED AREAS SHALL WATERED WHENEVER 7 DAYS ELAPSE WITHOUT A RAIN EVENT.
19. WHEN THE DISTURBED AREA HAS BEEN STABILIZED BY PERMANENT VEGETATION OR OTHER MEANS, TEMPORARY BMP'S SUCH AS SILT FENCES, STRAW BALES, AND SEDIMENT TRAPS SHALL BE REMOVED AND THESE AREAS STABILIZED.
20. ALL TEMPORARY BEST MANAGEMENT PRACTICES SHALL BE MAINTAINED UNTIL THE SITE IS STABILIZED.
21. ALL DISTURBED AREAS SHALL BE PERMANENTLY STABILIZED WITH SEED AND MULCH UNLESS OTHERWISE SPECIFIED. A MINIMUM OF FOUR INCHES OF TOPSOIL SHALL BE APPLIED TO ALL AREAS TO BE SEEDED OR SODDED.

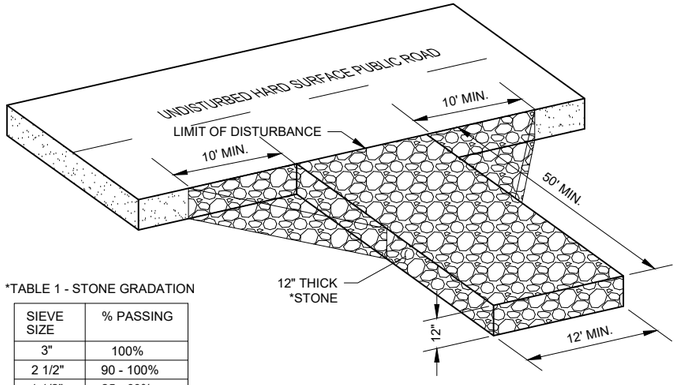
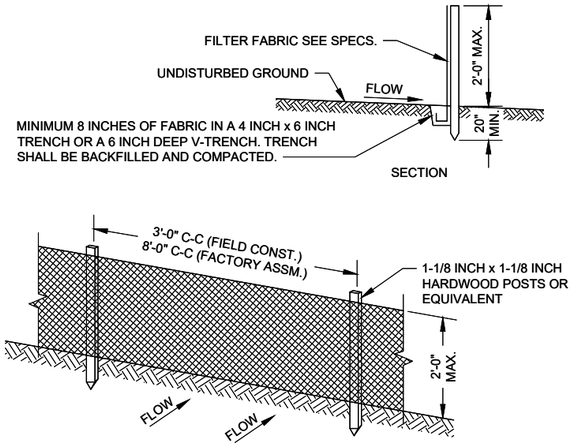


*TABLE 1 - STONE GRADATION

SIEVE SIZE	% PASSING
3"	100%
2 1/2"	90 - 100%
1 1/2"	25 - 60%
3/4"	0 - 20%
3/8"	0 - 5%

NOTES:
1. TRACKING PAD WIDTH SHALL BE AT LEAST THE FULL WIDTH OF HTE EGRESS POINT OR 12' WIDE MINIMUM.
2. TRACKING PAD LENGTH SHALL BE 50' FOR CONSTRUCTION SITES, 30' FOR SINGLE FAMILY RESIDENTIAL, OR AS SPECIFIED IN THE CONTRACT DOCUMENTS. LENGTH OF TRACKING PAD MAY NEED TO BE INCREASE OR ADDITIONAL SEDIMENT CONTROL PRACTICES SHALL BE INSTALLED BY THE CONTRACTOR IS SEDIMENT TRACK-OUT OCCURS.
3. GEOTEXTILE FABRIC TYPE R SHALL BE INSTALLED BETWEEN THE STONE AND SUBGRADE ON SITES WHERE HIGH GROUND WATER IS OBSERVED.
4. CONTRACTOR SHALL CLEAN STREET/ROADWAY ADJACENT TO ALL CONSTRUCTION ACCESS POINTS AT THE END OF EACH WORKDAY OR MORE FREQUENTLY IF REQUESTED.

STONE TRACKING PAD
NO SCALE

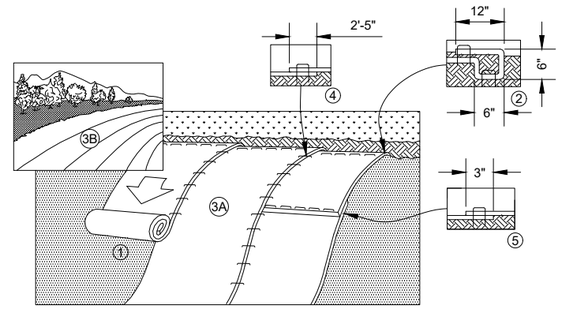


PERSPECTIVE VIEW

GENERAL NOTES:

1. ENDS OF FENCE SHALL BE TURNED UPSLOPE 1 TO 2 FEET IN ELEVATION TO PREVENT FLANKING.
2. STAPLE FABRIC WITH 1/2 INCH (MINIMUM) STAPLES TO THE UPSLOPE SIDE OF THE POSTS.
3. WHEN TWO SECTIONS OF FILTER FABRIC ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED.

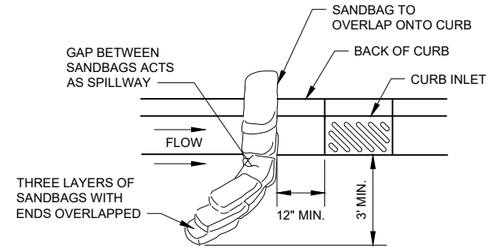
TYPICAL SILT FENCE INSTALLATION AT SITE PERIMETER DETAIL
NO SCALE

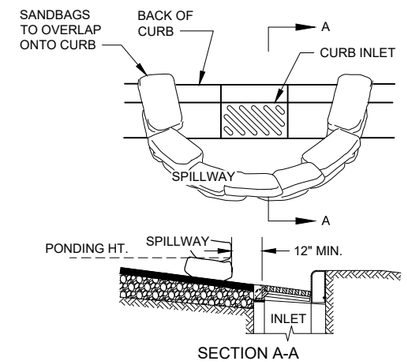


1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF BLANKET EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL THE BLANKETS (A) DOWN OR (B) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"-5" (5 CM-12.5 CM) OVERLAP DEPENDING ON BLANKET TYPE.
5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5 CM) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30 CM) APART ACROSS ENTIRE BLANKET WIDTH.

NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

EROSION CONTROL BLANKET DETAIL
NO SCALE





SECTION A-A

CURB INLET SEDIMENT BARRIER (SANDBAG TYPE) DETAIL
NO SCALE

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

PLOT DATE: 11/17/2025 1:11 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Civil Details.dwg

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CIVIL DETAILS
EROSION CONTROL DETAILS

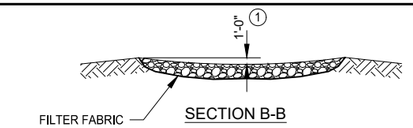
PROJECT NO. 07985049.2
SHEET 05-C501

TABLE OF QUANTITIES
RIPRAP AT RCP OUTLETS

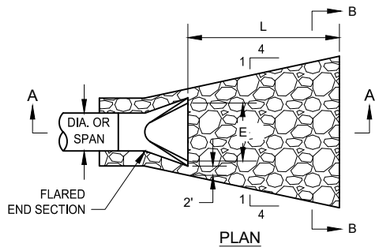
DIA. OF ROUND PIPE (IN.)	L (FT.)	12" DEPTH RIPRAP (CU.YDS.)	18" DEPTH RIPRAP (CU.YDS.)	24" DEPTH RIPRAP (CU.YDS.)
12	8	2.8	4.1	5.5
15	8	2.9	4.4	5.8
18	10	3.9	5.9	7.8
21	10	4.2	6.3	8.4
24	12	5.5	8.3	11.0
27	12	5.8	8.7	11.6
30	14	7.3	10.9	14.5
36	16	9.2	13.8	18.3
42	18	10.9	16.3	21.7
48	20	12.9	19.4	25.8

TABLE OF QUANTITIES
RIPRAP AT HERCP OUTLETS
OR BOXES OF EQUIVALENT SPAN WIDTH

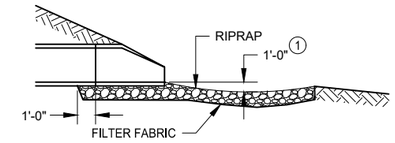
SPAN OF HERCP (IN.)	L (FT.)	LIGHT d50=6" 12" DEPTH RIPRAP (CU.YDS.)	MEDIUM d50=9" 18" DEPTH RIPRAP (CU.YDS.)	HEAVY d50=12" 24" DEPTH RIPRAP (CU.YDS.)
22	10	3.9	5.9	7.8
30	12	5.5	8.2	10.9
38	14	7.2	10.8	14.3
45	16	9.2	13.7	18.3
53	18	10.9	16.3	21.7
60	20	12.7	19.0	25.4



SECTION B-B



PLAN



SECTION A-A

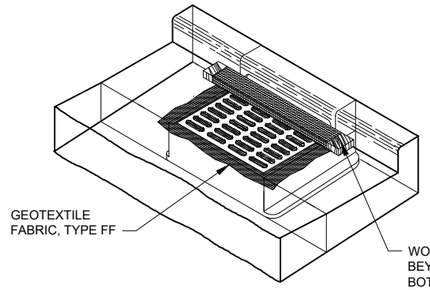
NOTES:

PIPE SIZES LARGER THAN THOSE SHOWN REQUIRE A SPECIAL DESIGN.

LIGHT RIPRAP SHALL BE UNDERLAIN WITH TYPE R FABRIC. MEDIUM AND HEAVY SHALL BE UNDERLAIN W/ TYPE HR FABRIC.

(1) FOR PIPES GREATER THAN OR EQUAL TO 30" USE 1.5'.

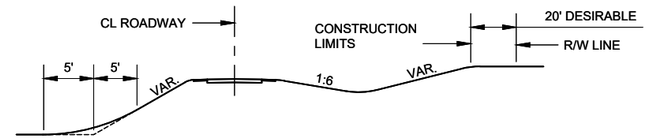
RIP RAP AT OUTLETS
NO SCALE



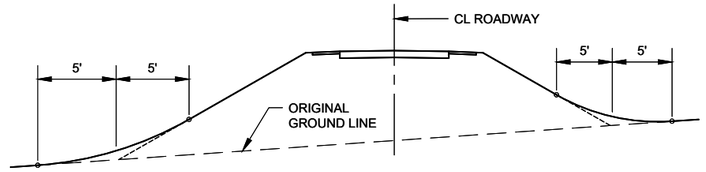
INSTALLATION NOTES:

TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE. THE CONTRACTOR SHALL DEMONSTRATE A METHOD OF MAINTENANCE, USING A SEWN FLAP, HAND HOLDS OR OTHER METHOD TO PREVENT ACCUMULATED SEDIMENT FROM ENTERING THE INLET.

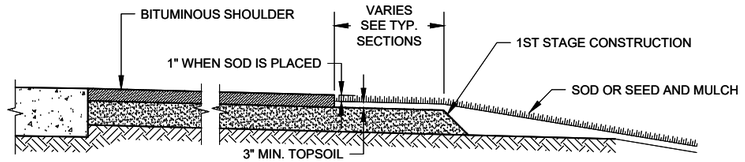
INLET PROTECTION, TYPE C
NO SCALE



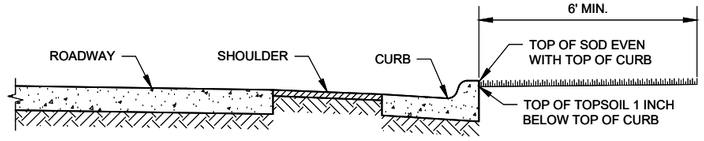
ROUNDING SHOULDERS AND BACKSLOPES



SHAPING FOR DRAINAGE ALONG THE TOE OF FILL SLOPES

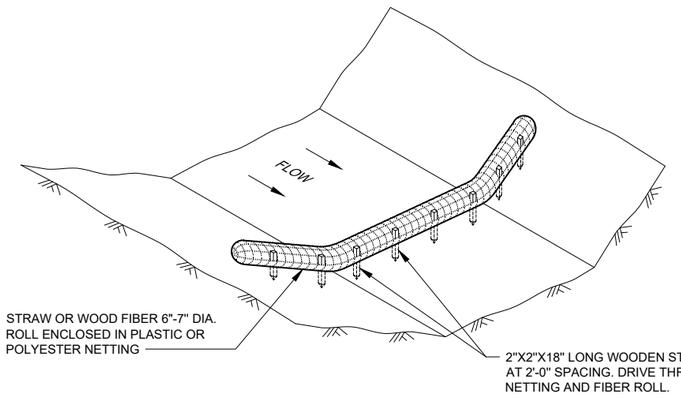


SHAPING AND TOPSOILING INSLOPES

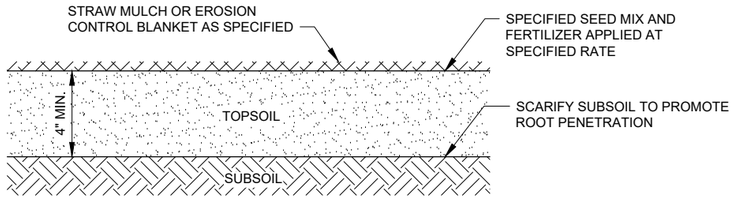


SHAPING ADJACENT TO CURBS WHEN SOD IS PLACED

SLOPE SHAPING DETAILS
NO SCALE



SEDIMENT LOG DETAIL
NO SCALE



NOTE: WHERE REQUIRED, PLANT HERBACEOUS PLUGS ACCORDING TO PLAN, OR AS DIRECTED BY ENGINEER.

TOPSOIL AND SEEDING DETAIL
NO SCALE

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

PLOT DATE: 11/17/2025 1:11 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Civil Details.dwg

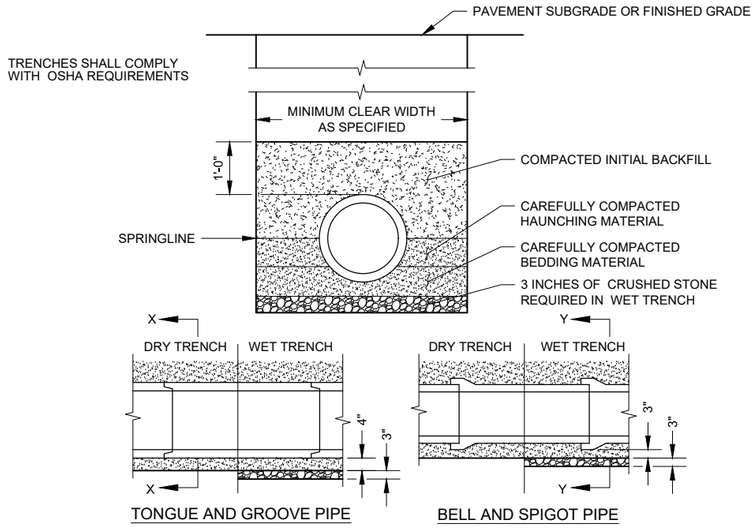
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CIVIL DETAILS
EROSION CONTROL DETAILS

PROJECT NO. 07985049.2
SHEET 05-C502



TONGUE AND GROOVE PIPE

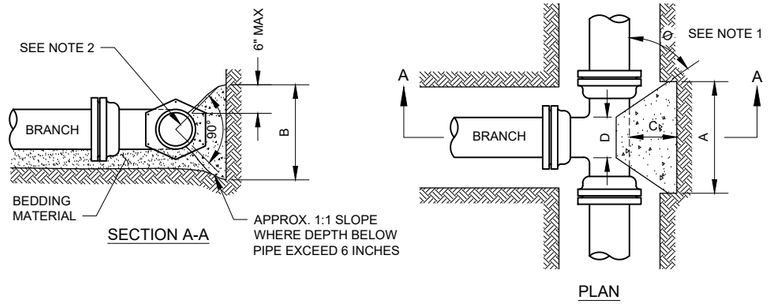
BELL AND SPIGOT PIPE

GENERAL NOTES:

1. BEDDING AND HAUNCHING MATERIAL SHALL BE WELL-GRADED 3/4 TO 1/4 INCH CRUSHED STONE OR OTHER NON-COHESIVE MATERIAL NOT SUBJECT TO MIGRATION AND FREE OF DEBRIS, ORGANIC MATERIAL, AND LARGE STONES.
2. BEDDING MATERIAL TO BE PLACED BEFORE SETTING PIPE, 4 INCH MINIMUM UNDER BARREL WITH 3 INCH MINIMUM UNDER BELL.
3. INITIAL BACKFILL SHALL BE DENSELY COMPACTED, NON-COHESIVE FINELY DIVIDED MATERIAL FREE OF DEBRIS, ORGANIC MATERIAL, AND LARGE STONES.
4. IN ROCK OR OTHER UNCOMPRESSIBLE MATERIALS, THE TRENCH SHALL BE OVEREXCAVATED A MINIMUM OF 6-INCHES AND REFILLED WITH GRANULAR MATERIAL.

CLASS "B" EMBEDMENT FOR RIGID PIPE DETAIL

NO SCALE



NOTES:

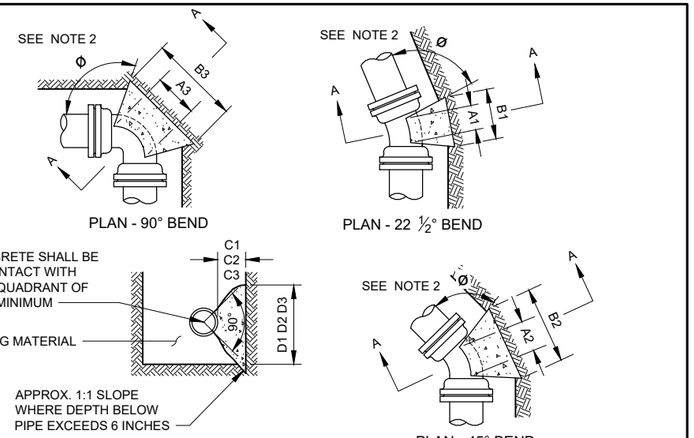
1. DIMENSION 'C' SHOULD BE LARGE ENOUGH TO MAKE ANGLE Ø GREATER THAN OR EQUAL TO 45°.
2. CONCRETE SHOULD BEAR ON THIS QUADRANT OF PIPE AT A MINIMUM.
3. DIMENSION 'D' SHOULD BE AS LARGE AS POSSIBLE BUT CONCRETE SHOULD NOT INTERFERE WITH MECHANICAL JOINTS.
4. BUTTRESS DIMENSIONS ARE BASED ON A SOIL RESISTANCE OF TWO TONS PER SQ. FT. AND A WATER PRESSURE OF 150 PSI. INFORM THE ENGINEER IF ON-SITE SOIL DOES NOT MEET THIS CONDITION OR PRESSURES EXCEED 150 PSI.
5. BUTTRESS TO BE PLACED AGAINST FIRM UNDISTURBED SOIL, OR DISTURBED SOIL COMPACTED TO 95%%% OF MODIFIED PROCTOR DENSITY, ASTM D1557.
6. CONCRETE SHALL HAVE A MINIMUM 7-DAY COMPRESSIVE STRENGTH OF 2000 PSI.
7. ALL POURED BUTTRESSED FITTINGS SHALL BE WRAPPED IN POLYETHYLENE.
8. IN ADDITION TO BUTTRESSES, ALL JOINTS SURROUNDING TEES SHALL BE RESTRAINED WITH WEDGE ACTION RESTRAINING GLANDS.

BUTTRESS DIMENSIONS				
DIA.	A	B	C	D
6"	1'-3"	1'-0"	SEE NOTE NO. 1	SEE NOTE NO. 3
8"	1'-6"	1'-4"		
10"	1'-10"	1'-8"		
12"	2'-3"	2'-0"		
16"	3'-2"	2'-6"		
20"	4'-0"	3'-0"		
24"	5'-3"	3'-4"		

DIA. = BRANCH DIAMETER

BUTTRESS FOR TEES DETAIL

NO SCALE



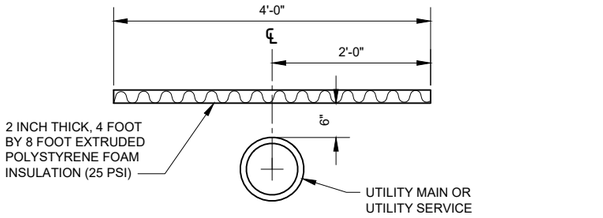
NOTES:

1. DIMENSIONS IN TABLE ARE BASED ON A WATER PRESSURE OF 150 P.S.I. AND AN EARTH RESISTANCE OF 2 TONS PER SQ. FT. INFORM THE ENGINEER IF PRESSURES EXCEED 150 PSI, OR ON-SITE SOIL DOES NOT MEET THIS CONDITION.
2. DIMENSION C1 C2 C3 SHOULD BE LARGE ENOUGH TO MAKE ANGLE Ø EQUAL TO OR LARGER THAN 45°.
3. DIMENSION A1 A2 A3 SHOULD BE AS LARGE AS POSSIBLE WITHOUT INTERFERING WITH THE MECHANICAL JOINT.
4. BUTTRESS TO BE POURED AGAINST FIRM UNDISTURBED SOIL, OR DISTURBED SOIL COMPACTED TO 95% OF MODIFIED PROCTOR DENSITY, ASTM D1557.
5. ALL BUTTRESSED FITTINGS SHALL BE WRAPPED IN POLYETHYLENE.
6. CONCRETE SHALL HAVE A MINIMUM 7-DAY COMPRESSIVE STRENGTH OF 2000 PSI.
7. IN ADDITION TO BUTTRESS, ALL JOINTS SURROUNDING BENDS SHALL BE RESTRAINED WITH WEDGE ACTION RESTRAINING GLANDS.

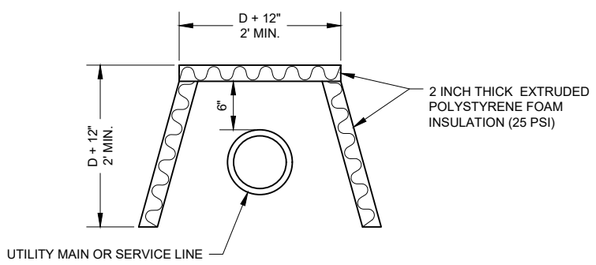
BUTTRESS DIMENSIONS						
PIPE SIZE	22 ½° BENDS		45° BENDS		90° BENDS	
	B1	D1	B2	D2	B3	D3
6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-2"
8"	1'-0"	1'-0"	1'-4"	1'-2"	1'-10"	1'-6"
10"	1'-2"	1'-2"	1'-7"	1'-7"	2'-3"	1'-10"
12"	1'-4"	1'-4"	1'-10"	1'-10"	2'-8"	2'-3"
16"	1'-10"	1'-8"	2'-6"	2'-4"	3'-10"	2'-10"
20"	2'-4"	2'-0"	3'-3"	2'-10"	5'-0"	3'-4"
24"	2'-10"	2'-4"	4'-0"	3'-3"	6'-4"	3'-10"

BUTTRESS FOR BENDS DETAIL

NO SCALE



STANDARD INSTALLATION



SIDE PROTECTION INSTALLATION

GENERAL NOTES:

1. THE SIDE PROTECTION INSTALLATION SHALL BE USED WHERE FROST WILL PENETRATE BELOW THE PIPE INVERT.

PIPE INSULATION DETAIL

NO SCALE

RESTRAINED/TIED PIPE LENGTH CHART						
MIN LENGTH REQUIRING RESTRAINT IN FEET						
	6"	8"	10"	12"	16"	24"
FITTING TYPE						
11.25° BEND	10	10	10	10	10	10
22.5° BEND	10	10	10	10	11	15
45° BEND	10	15	15	20	25	30
90° BEND	25	30	35	40	55	75
TEE/CROSS	15	25	35	45	65	95
STUB OR PLUG	30	35	45	50	95	100
REDUCER	0	20	35	50	105	125
VERTICAL BEND (45°)	20	30	35	40	50	75

THE ABOVE LENGTHS (GIVEN IN FEET) REPRESENT THE MINIMUM LENGTH OF PIPE TO BE TIED TOGETHER IN EACH REQUIRED DIRECTION FROM THE FITTING DESCRIBED

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

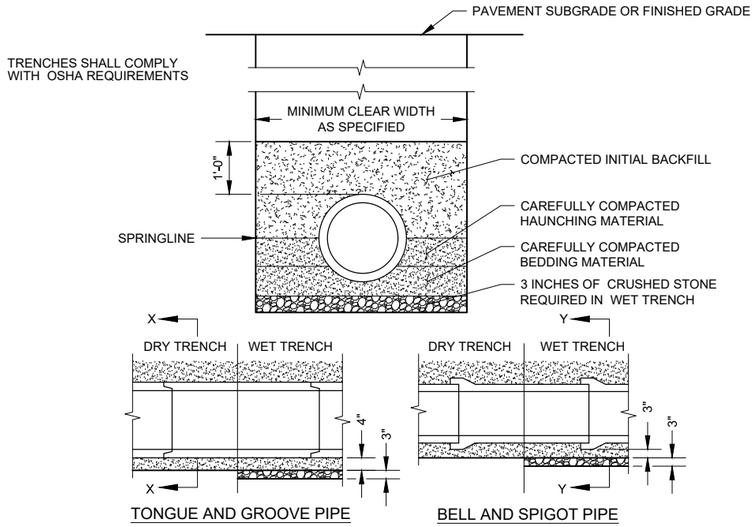
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CIVIL DETAILS
WATERMAIN DETAILS

PROJECT NO. 07985049.2
SHEET 05-C503



TONGUE AND GROOVE PIPE

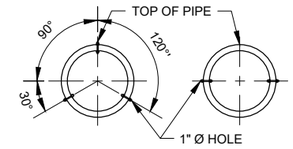
BELL AND SPIGOT PIPE

GENERAL NOTES:

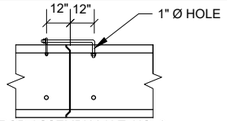
1. BEDDING AND HAUNCHING MATERIAL SHALL BE WELL-GRADED 3/4 TO 1/4 INCH CRUSHED STONE OR OTHER NON-COHESIVE MATERIAL NOT SUBJECT TO MIGRATION AND FREE OF DEBRIS, ORGANIC MATERIAL, AND LARGE STONES.
2. BEDDING MATERIAL TO BE PLACED BEFORE SETTING PIPE, 4 INCH MINIMUM UNDER BARREL WITH 3 INCH MINIMUM UNDER BELL.
3. INITIAL BACKFILL SHALL BE DENSELY COMPACTED, NON-COHESIVE FINELY DIVIDED MATERIAL FREE OF DEBRIS, ORGANIC MATERIAL, AND LARGE STONES.
4. IN ROCK OR OTHER UNCOMPRESSIBLE MATERIALS, THE TRENCH SHALL BE OVEREXCAVATED A MINIMUM OF 6-INCHES AND REFILLED WITH GRANULAR MATERIAL.

CLASS "B" EMBEDMENT FOR RIGID PIPE DETAIL

NO SCALE

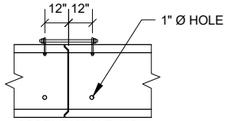


TRANSVERSE SECTION



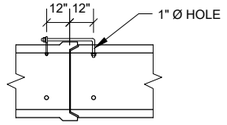
ROD ASSEMBLY ALT. NO. 2
TONGUE AND GROOVE EYE BOLT AND TIE

LONGITUDINAL SECTION



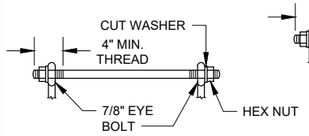
ASSEMBLY ALT. NO. 1
TONGUE & GROOVE EYE BOLT AND TIE ROD

LONGITUDINAL SECTION

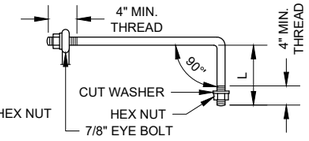


ASSEMBLY ALT. NO. 2
MODIFIED BELL EYE BOLT AND TIE ROD

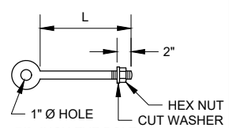
LONGITUDINAL SECTION



ALT. NO. 1 - 7/8 INCH TIE ROD



ALT. NO. 2 - 7/8 INCH TIE ROD



7/8 INCH EYE BOLT

EYE BOLT DIMENSION TABLE

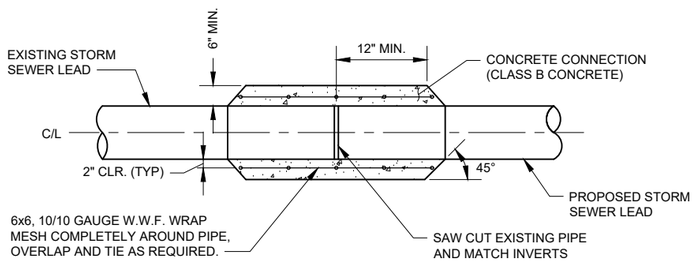
PIPE SIZE (INCHES)	LENGTH, L (INCHES)	
	TONGUE & GROOVE PIPE	MODIFIED BELL PIPE
18 TO 24	4 1/2	5 1/2
30	5	7
36	5 1/2	7
42	5	
48	6 1/2	
60	7 1/2	
72	8 1/2	

GENERAL NOTES:

1. CONCRETE CULVERT PIPE SHALL BE TIED TOGETHER IN THE MANNER ILLUSTRATED BY THIS DETAIL AT LOCATIONS DESIGNATED ON THE PLAN OR AS DIRECTED BY THE ENGINEER.
2. DETAILED DRAWINGS FOR PROPOSED ALTERNATE DESIGNS FOR JOINT TIES SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
3. HOLES SHALL BE FILLED WITH A NON-SHRINK GROUT OR A NON-SHRINK EPOXY GROUT AS DIRECTED BY THE ENGINEER
4. BOLT PROJECTION INSIDE OF PIPE SHALL NOT EXCEED 2 INCHES.

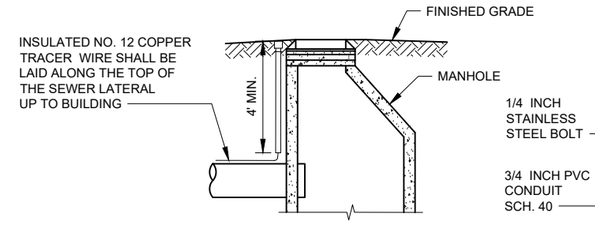
CONCRETE PIPE JOINT TIE DETAIL

NO SCALE

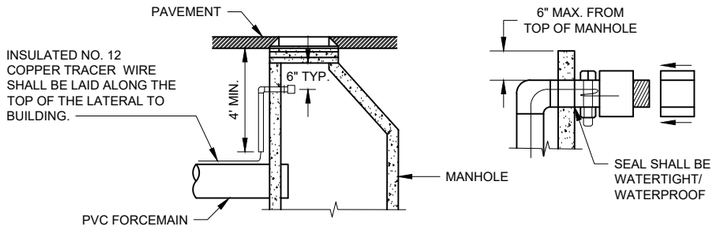


STORM SEWER CONNECTION DETAIL

NO SCALE



INSTALLATION IN UNPAVED AREA



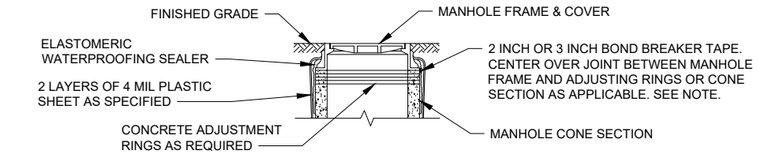
INSTALLATION IN PAVED AREA

GENERAL NOTES:

1. THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE.
2. A THREADED, FEMALE PVC SCHEDULE 40 PLUG AND MALE COUPLING GLUED TO 3/4 INCH SCHEDULE 40 SHALL BE INSTALLED IN OR ADJACENT TO THE VALVE VAULT AND MANHOLE.
3. WIRE PIGTAIL SHALL BE WRAPPED AROUND BOLT AND READILY ACCESSIBLE, WITH SUFFICIENT LENGTH FOR EASY CONNECTION.
4. SNAKEPIT TRACER WIRE SYSTEMS MAY BE SUBSTITUTED IN LIEU OF DETAILED PRODUCTS.

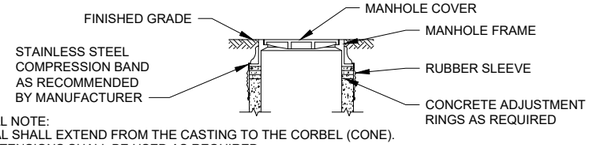
TRACER WIRE INSTALLATION FOR SANITARY LATERALS

NO SCALE



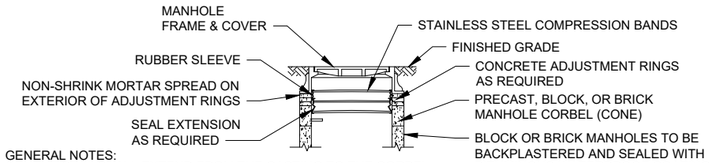
THE BOND BREAKER TAPE IS TO PREVENT THE SEALER FROM BONDING TO THE EDGE OF THE FLANGE OF THE MH FRAME AND THE UPPER 1-1/2 INCHES OF ADJUSTING RING OR CONE. IF THE EDGE OF FLANGE IS NOT FLUSH WITH ADJUSTING RING OR CONE, APPLY ADDITIONAL TAPE AS REQUIRED TO PREVENT SUCH BONDING.

ELASTOMERIC FRAME/CHIMNEY SEAL



GENERAL NOTE:
THE SEAL SHALL EXTEND FROM THE CASTING TO THE CORBEL (CONE). SEAL EXTENSIONS SHALL BE USED AS REQUIRED.

EXTERNAL RUBBER SLEEVE FRAME/CHIMNEY SEAL



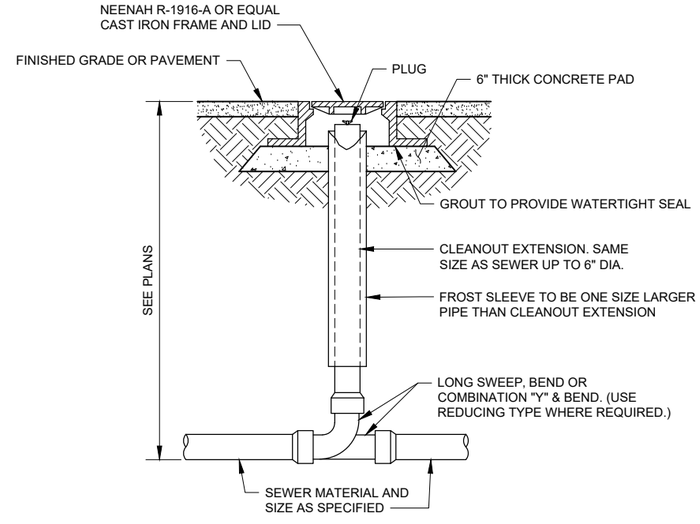
GENERAL NOTES:

1. THE SEAL SHALL EXTEND FROM THE CASTING TO THE CORBEL (CONE). SEAL EXTENSIONS SHALL BE USED AS REQUIRED.
2. AN INTERNAL ADAPTOR SEAL RING MAY BE USED IN LIEU OF THE RUBBER SLEEVE. THE INTERNAL ADAPTOR SEAL RING SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS.

INTERNAL RUBBER SLEEVE FRAME/CHIMNEY SEAL

MANHOLE WATERPROOFING DETAIL

NO SCALE



EXTERIOR CLEANOUT IN ROADWAY DETAIL

NO SCALE

NO.	DATE	REVISION	BY

PROJECT DATE: NOVEMBER 18, 2025
DRAWN BY: JJY
DESIGNED BY: ATR
CHECKED BY: EE

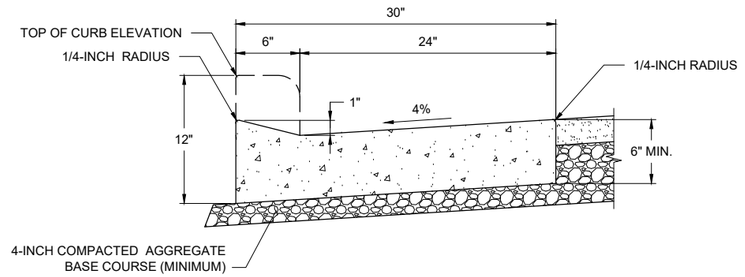
PLOT DATE: 11/17/2025 1:11 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Civil Details.dwg

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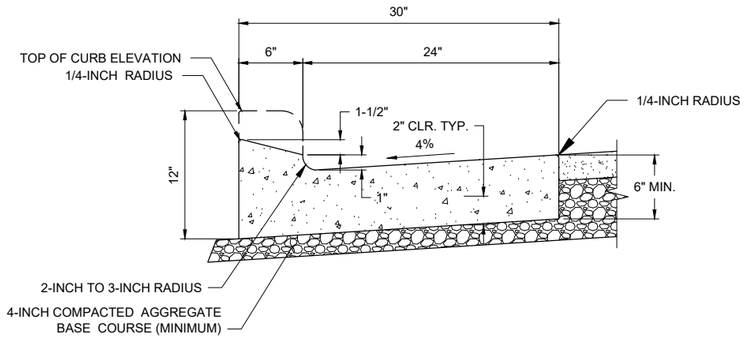
BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

CIVIL DETAILS
STORM & SANITARY SEWER DETAILS

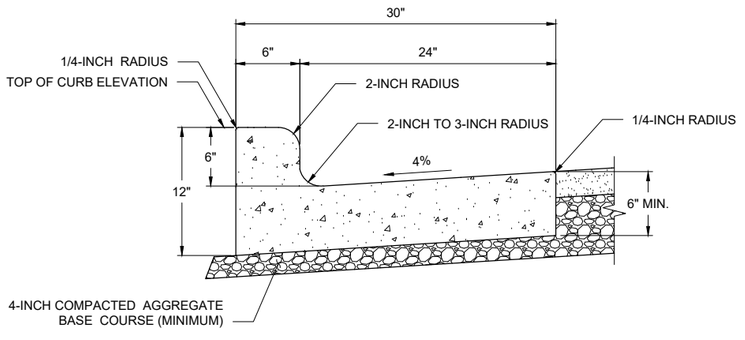
PROJECT NO. 07985049.2
SHEET 05-C504



DRIVEWAY SECTION



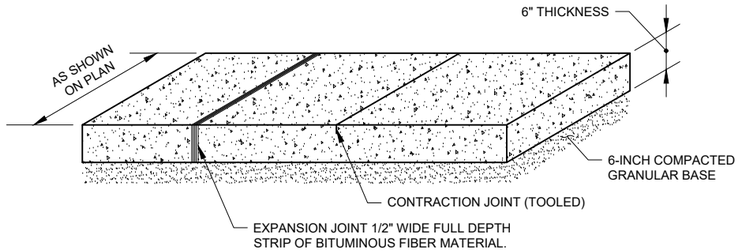
SPECIAL DRIVEWAY SECTION



STANDARD SECTION

TYPE L CURB AND GUTTER DETAIL

NO SCALE

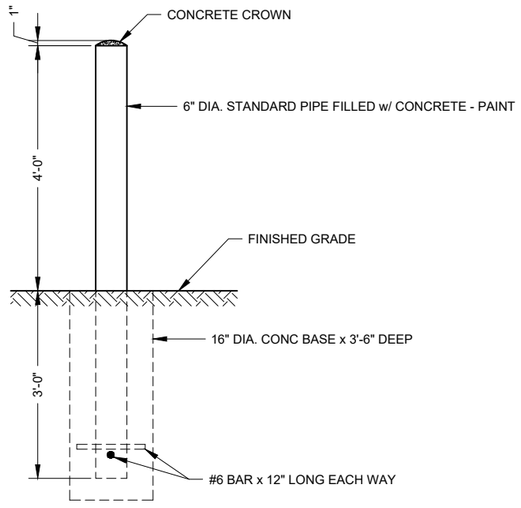


SIDEWALK NOTES:

1. ALL EXPOSED CONCRETE SHALL HAVE A LIGHT BROOM FINISH.
2. EXPANSION JOINTS SHALL BE PLACED AT ABUTTING WALKS, DRIVEWAYS, CURBS, OR OTHER FIXTURES.
3. EXPANSION JOINT MAXIMUM SPACING SHALL BE 96 FEET.
4. CONTRACTION JOINT SPACING TYPICALLY EQUAL TO SIDEWALK WIDTH.
5. CROSS SLOPE TYPICAL 1.5%

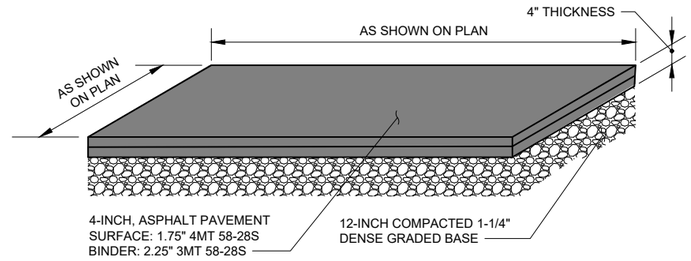
CAST-IN-PLACE-CONCRETE DETAIL

NO SCALE



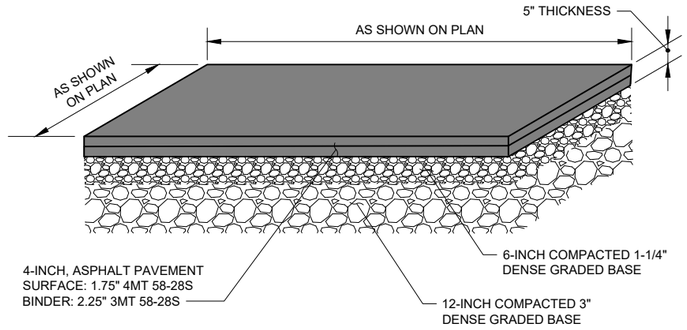
BOLLARD (GUARD POST) DETAIL

NO SCALE



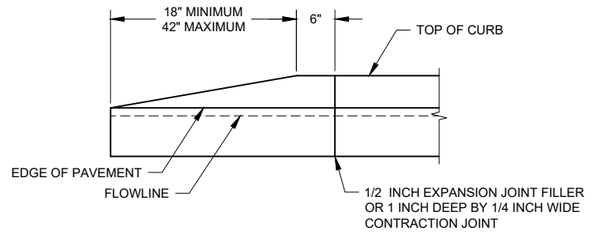
DRIVEWAY & BRADY LANE PAVEMENT PATCH PAVEMENT DETAIL

NO SCALE



COUNTY HWY K PAVEMENT PATCH PAVEMENT DETAIL

NO SCALE



CURB END DETAIL

NO SCALE

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

PLOT DATE: 11/17/2025 1:11 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Civil Details.dwg

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

CIVIL DETAILS
STREET DETAILS

PROJECT NO. 07985049.2
SHEET 05-C505

SDD 15C04 Traffic Control, Advance Warning Signs 45 MPH or Greater Undivided Road Open to Traffic

GENERAL NOTES

THE EXACT NUMBER, LOCATION, AND SPACING OF ALL SIGNS AND DEVICES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS.

THE SPACING BETWEEN TRAFFIC CONTROL SIGNS SHOULD BE ADJUSTED TO NOT CONFLICT WITH AND SHOULD PROVIDE A MINIMUM OF 200 FEET (500 FEET DESIRABLE) CLEARANCE TO EXISTING SIGNS THAT WILL REMAIN IN PLACE.

ALL SIGNS ARE 48" X 48" UNLESS OTHERWISE NOTED.

SIGNS THAT WILL BE IN PLACE LESS THAN SEVEN CONTINUOUS DAYS AND NIGHTS MAY BE MOUNTED ON PORTABLE SUPPORTS.

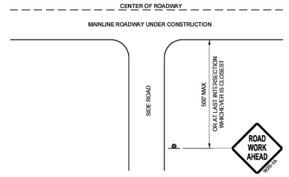
IF A "STOP" SIGN MUST BE REMOVED FOR A WORK OPERATION, A TEMPORARY "STOP" SIGN SHALL BE PLACED PRIOR TO THE SIGN REMOVAL, OR A FLAGGER SHALL BE PROVIDED UNTIL THE SIGN IS REESTABLISHED.

★ OMIT G20-1 SIGNS IF LENGTH OF WORK AREA IS 2 MILES OR LESS

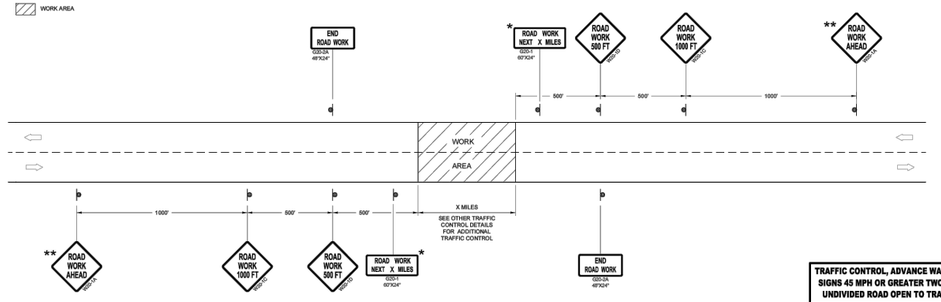
★★ PLACE AN ADDITIONAL W20-1A "ROAD WORK AHEAD" SIGN IF WORK AREA WITHIN THE PROJECT IS SEPARATED BY MORE THAN 2 MILES FROM PREVIOUS WORK AREA

LEGEND

- SIGN ON PERMANENT SUPPORT
- DIRECTION OF TRAFFIC
- WORK AREA



TYPICAL SIDE ROAD APPROACH WARNING SIGN DETAIL



TRAFFIC CONTROL, ADVANCE WARNING SIGNS 45MPH OR GREATER

TRAFFIC CONTROL, ADVANCE WARNING SIGNS 45 MPH OR GREATER TWO-WAY UNDIVIDED ROAD OPEN TO TRAFFIC

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

APPROVED
July 2018 — DATE
/S/ Andrew Heidtke — WORK ZONE ENGINEER

FHWA

SDD 15C04 - 05

SDD 15D28 Traffic Control, Work on Shoulder or Parking Lane, Undivided Roadway

LEGEND

- SIGN ON PERMANENT SUPPORT
- TRAFFIC CONTROL DRUM
- DIRECTION OF TRAFFIC
- WORK ZONE

GENERAL NOTES

ALL SIGNS ARE 48"X48" UNLESS OTHERWISE NOTED. IF NECESSARY DUE TO SPACE CONSTRAINTS IN URBAN AREAS, 36" X 36" SIGNS MAY BE USED IF APPROVED BY THE REGIONAL TRAFFIC UNIT.

"W3" SIGN IS THE SAME AS "W" SIGN EXCEPT THE BACKGROUND IS ORANGE.

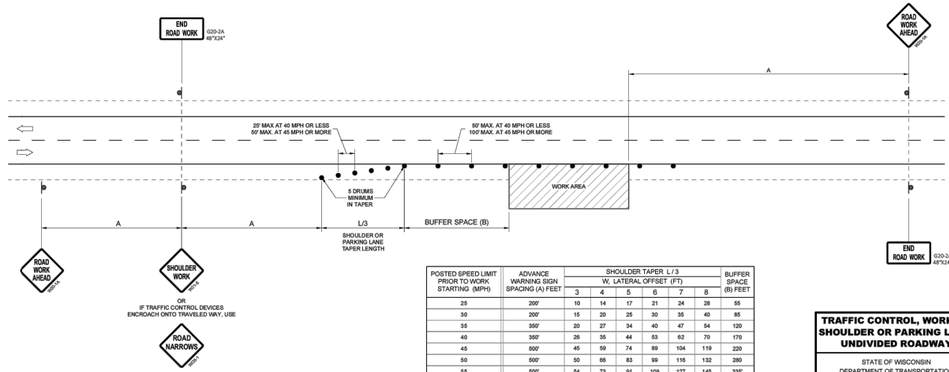
ANY SIGNS TEMPORARY OR EXISTING, WHICH CONFLICT WITH THE TRAFFIC CONTROL "IN USE" SHALL BE REMOVED OR COVERED AS NEEDED AND AS APPROVED BY THE ENGINEER.

THE EXACT NUMBER, LOCATION, AND SPACING OF ALL SIGNS AND DEVICES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS AS APPROVED BY THE ENGINEER.

CHANNELIZING DEVICES PLACED ADJACENT TO WORK AREA SHALL BE PULLED BACK FROM THE TRAVEL LANE WHEN WORK IS NOT IN PROGRESS.

SIGNS THAT WILL BE IN PLACE LESS THAN 7 CONTINUOUS DAYS AND NIGHTS MAY BE MOUNTED ON PORTABLE SUPPORTS.

W20-1A AND G20-2A SIGNS ARE NOT REQUIRED IF THE WORK AREA IS WITHIN A LARGER WORK ZONE WHERE THESE SIGNS ARE ALREADY PRESENT. G20-2A SIGNS MAY ALSO BE OMITTED IF DURATION OF WORK IS LESS THAN 7 CONTINUOUS DAYS AND NIGHTS.



POSTED SPEED LIMIT PRIOR TO WORK STARTING (MPH)	ADVANCE WARNING SIGN SPACING (A) FEET	SHOULDER TAPER L / 3 W, LATERAL OFFSET (FT) 3	4	5	6	7	8	BUFFER SPACE (B) FEET
25	200'	10	14	17	21	24	28	55
30	200'	15	20	25	30	35	40	65
35	350'	20	27	34	40	47	54	120
40	350'	26	35	44	53	62	70	170
45	500'	45	59	74	89	104	119	220
50	500'	50	66	83	99	116	132	280
55	500'	54	73	91	109	127	145	335'

TRAFFIC CONTROL, WORK ON SHOULDER OR PARKING LANE, UNDIVIDED ROADWAY

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

APPROVED
May 2020 — DATE
/S/ Andrew Heidtke — STATEWIDE WORK ZONE TRAFFIC SAFETY ENGINEER

FHWA

SDD 15D28 - 04

		NO.	DATE	REVISION	BY
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	.	.	.	.
	DESIGNED BY: ATR	.	.	.	.
	CHECKED BY: EE	.	.	.	.

PLOT DATE: 11/17/2025 1:11 PM, G:\07\07985\07985049\CADD\Construction Documents\07985049 Civil Details.dwg

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

CIVIL DETAILS
TRAFFIC CONTROL DETAILS

PROJECT NO. 07985049.2
SHEET 05-C506

20-PLC-1
PRV STATION PLC
CONTROL PANEL

PRV STATION SCADA SYSTEM FUNCTIONS

ALARMS
- VALVE FAIL — YA 20-1-1-1
- PAH 20-3-1-1 (2)
- PAL 20-3-1-1 (2)
- FREEZE STAT — TAL 20-4-1-1

CONTROL
- O/C/ AUTO — HS 20-1-1-1
- VALVE CNTRL — XIC 20-1-1-1
- FIC 20-2-1-1

INTERLOCKS
- LAL 10-2-1-1

STATUS
- REQ'D POSITION — ZI 20-1-1-1
- ZI 20-1-1-2
- FLOW IND — FI 20-2-1-1
- FLOW RATE — FI 20-2-1-2
- PI 20-3-1-1 (2)

TRENDS
- FLOW TOTAL — ZIR 20-1-1-1
- FQI 20-2-1-1
- DAILY TOTAL — FQR 20-2-1-1

COMMUNICATION SCADA SYSTEM FUNCTIONS

ALARMS
- CNTRL PWR — YA 20-5-1-1
- UPS FAULT — YA 20-5-1-2
- COMM FAIL — YA 20-5-1-3

STATUS
- COMM STATUS — YL 20-5-1-1

CONTROL
- PLC ACTIV. — KIC 20-5-1-1

DI — CNTRL PWR — JS 20-5-1
DO — SCAN DELAY — KQ 20-5-1
DI — UPS FAULT — JA 20-5-1
PLC FAIL — YA 20-5-1

AI — A — ** — PRV CONTROLLER — XVC 20-1-1
AI — PRESSURE
DI — LOW TEMP
OPEN — POSITION — CLOSE
PRESSURE
DI — FLOW TOTAL
AI (2) — FORWARD & BACKWARD FLOW RATE (2)

PRV ENCLOSURE — TSL 20-4-1

S — S

PIT 20-3-2 — PI 20-3-2 — WV-20-1-3 8" BFV ** — 8"-W1 — WCV-20-1-1 ** 8" PRV O/C — 8"-W1 — WV-20-1-2 8" BFV ** — PIT 20-3-1 — PI 20-3-1

8"-W1 — WV-20-1-4 8" BFV ** — 8"-W1

8" — FE 20-2-1 — M — M — FIT 20-2-1

8"-W1 — 12"x8" — WV-20-1-5 12" GV ** — 12"-W1

8"-W1 — 12"x8" — WV-20-1-1 12" GV ** — 12"-W1

12"-W1 — 12"-W1 — WV-20-1-6 12" GV ** — 12"-W1 — 12"-W1

LOW-PRESSURE ZONE

STR-20, PRESSURE REDUCING VALVE STATION

HIGH-PRESSURE ZONE

PLOT DATE: 11/18/2025 5:09:26 PM
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PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: AMS	No	DATE	REVISIONS	BY
	DESIGNED BY: AMS				
	CHECKED BY: LET				

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PRV STATION P&ID NO.1

PROJECT NO. 07985049.2
SHEET 06-N601

30-PLC-1
NORTH BOOSTER STATION
PLC CONTROL PANEL
(PARTIAL)

NORTH BOOSTER STATION SCADA SYSTEM FUNCTIONS

- ALARMS
  - UA 30-1-1-1 MTR (2)
  - PAH 30-4-1-1 (2)
  - PAL 30-4-1-1 (2)
- CONTROL
  - UX 30-1-1-1 MTR (2)
  - PRS/LVL/ HS 10-1-1-2 AUTO
  - FIC 30-3-1-1
  - PIC 30-4-1-1 (2)
  - SET POINTS PUK 30-4-1-1 (2)
  - EST SET POINTS LIC 10-2-1-1
- INTERLOCKS
  - PUMPS OFF FC 30-2-1-1
- STATUS
  - UL 30-1-1-1 MTR (2)
  - PRV FLOW FI 30-2-1-1
  - FLOW IND FI 30-3-1-1
  - FLOW RATE FI 30-3-1-2
  - PI 30-4-1-1 (2)
  - TOWER LEVEL LI 10-2-1-1
- TRENDS
  - UIR 30-1-1-1 MTR (2)
  - FLOW TOTAL FQI 30-3-1-1
  - DAILY TOTAL FQR 30-3-1-1
- DATA
  - UQR 30-1-1-1 MTR (2)

INTRUSION SCADA SYSTEM FUNCTIONS

- ALARMS
  - ZAL 30-6-1 INTR

BUILDING SCADA SYSTEM FUNCTIONS

- ALARMS
  - FREEZE STAT TAL 30-7-1-1
  - FLOOD LAH 30-7-1-1

POWER & COMMUNICATION SCADA SYSTEM FUNCTIONS

- ALARMS
  - E-STOP ENGAGED YA 30-8-1-1
  - NOT IN AUTO YA 30-8-1-2
  - UTILITY FAIL JA 30-8-1-1
  - ATS IN STBY JA 30-8-1-2
  - GENSET RUN JA 30-8-1-3
  - GENSET FAIL JA 30-8-1-4
- STATUS
  - GENSET R.T. KQI 30-8-1-1
  - DAILY R.T. KQR 30-8-1-1
  - DAILY STARTS YQR 30-8-1-1
  - GENSET EXERCISE JL 30-8-1-1

COMMUNICATION SCADA SYSTEM FUNCTIONS

- ALARMS
  - CNTRL PWR YA 30-9-1-1
  - UPS FAULT YA 30-9-1-2
  - COMM FAIL YA 30-9-1-3
- STATUS
  - COMM STATUS YL 30-9-1-1
- CONTROL
  - PLC ACTIV. KIC 30-9-1-1

DI CNTRL PWR JS 30-9-1 — DO SCAN DELAY KQ 30-9-1
DI UPS FAULT JA 30-9-1 — DO PLC FAIL YA 30-9-1

DI LEVEL — DI PRESS. — DI AUTO — HS 30-1-1-1 LPA

DI ZAL 30-6-1 DO

AI (2) FORWARD & BACKWARD FLOW RATE (2)
DI FLOW TOTAL
AI PRESSURE
DI ETHERNET COMMS (2)
DI FLOW
AI PRESSURE
DI INTRUSION — ZS 30-6-1 DOOR SWITCH
AI TEMP — TIT 30-7-1 BOOSTER ROOM
DI FLOOD — LSH 30-7-1 BOOSTER ROOM
DI (2) UTILITY AVAIL. / GEN AVAIL. (2)
DI GENSET EXERCISE
DI ON UTILITY
DI ON GEN
DI GENSET RUN
DI GENSET FAIL
DI NOT IN AUTO
DI E-STOP ENGAGED

DI (2) MTR TEMP (2)
DI (2) RESET (2)
DO (2) AFD RUN (2)
DO (2) AFD FAIL (2)
DI (2) AFD START (2)
DO (2) REQ'D (2)
DI (2) CNTRL AVAIL. (2)
AFD AFD-30-1-1 (2)

30-ATS-1
NORTH BOOSTER STATION
AUTOMATIC TRANSFER SWITCH

LCP-30-8-1
NORTH BOOSTER STATION STANDBY
GENERATOR CONTROL PANEL
HS 30-8-1 E-STOP
GENSET REQ'D
XS 30-8-1 E-STOP

LCP-30-8-2
NORTH BOOSTER STATION STANDBY
GENERATOR REMOTE ANNUNCIATOR

** FIT 30-3-1 — ** FE 30-3-1 — PIT 30-4-1 — ** PI 30-4-1

8"-W1 — 8" — 8"-W1 — 8"-W1

LOW-PRESSURE ZONE

06-N602 30-A CLS FROM HYPOCHLORITE CHEMICAL PUMP

** TSH 30-1-1 MTR TEMP — BOOSTER PUMP NO.1 P-30-1-1 **
** TSH 30-1-2 MTR TEMP — BOOSTER PUMP NO.2 P-30-1-2 **
*** TSH 30-1-3 MTR TEMP — BOOSTER PUMP NO.3 P-30-1-3 ***

6"-W1 — WV-30-1-1 6" BFV ** — 6"x4" — 4"-W1 — 2 1/2"-W1 — 6"x2 1/2" — 6"-W1 — WV-30-1-2 6" CV ** — WV-30-1-3 6" BFV **
6"-W1 — WV-30-1-4 6" BFV ** — 6"x4" — 4"-W1 — 2 1/2"-W1 — 6"x2 1/2" — 6"-W1 — WV-30-1-5 6" CV ** — WV-30-1-6 6" BFV **
6"-W1 — WV-30-1-7 6" BFV ** — 6"x4" — 4"-W1 — 2 1/2"-W1 — 6"x2 1/2" — 6"-W1 — WV-30-1-8 6" CV *** — WV-30-1-9 6" BFV **

FS 30-2-1
6"-W1 — WV-30-2-3 6" BFV ** — 6"-W1 — WV-30-2-2 6" PRV ** — WV-30-2-1 6" BFV ** — 8"-W1

PIT 30-4-2 — ** PI 30-4-2

HIGH-PRESSURE ZONE

STR-30, NORTH BOOSTER STATION

30-PLC-1
NORTH BOOSTER STATION
PLC CONTROL PANEL
(PARTIAL)

CHEMICAL FEED SYSTEM SCADA SYSTEM FUNCTIONS

- ALARMS
  - PUMP FAIL YA 30-5-1-1
  - LOW LVL LAL 30-5-1-1
- STATUS
  - PUMP REQ'D YL 30-5-1-1
  - PUMP SI 30-5-1-1
  - DAILY USAGE QIR 30-5-1-1
  - TODAY USAGE QIR 30-5-1-2
- CONTROL
  - FLOW PACE SIC 30-5-1-1
  - HS 30-5-1-1 HOA
- TRENDS
  - PUMP RUN SIR 30-5-1-1
  - TANK LVL LIR 30-5-1-1
- INTERLOCKS
  - PUMP RUN YS 30-1-1-1
  - FLOW LPZ TO HPZ YS 30-3-1-1

AI LEVEL — DO REQ'D — DI FAULT — DI RUN — AI SPEED — AO PACE

*** LT 30-5-1

CLS — HYPOCHLORITE CHEMICAL PUMP P-30-5-1 *** — CLS — 30-A 06-N602 TO BOOSTER PUMPS SUCTION HEADER

T-30-6-1 HYPOCHLORITE STORAGE TANK ***

STR-30, NORTH BOOSTER STATION

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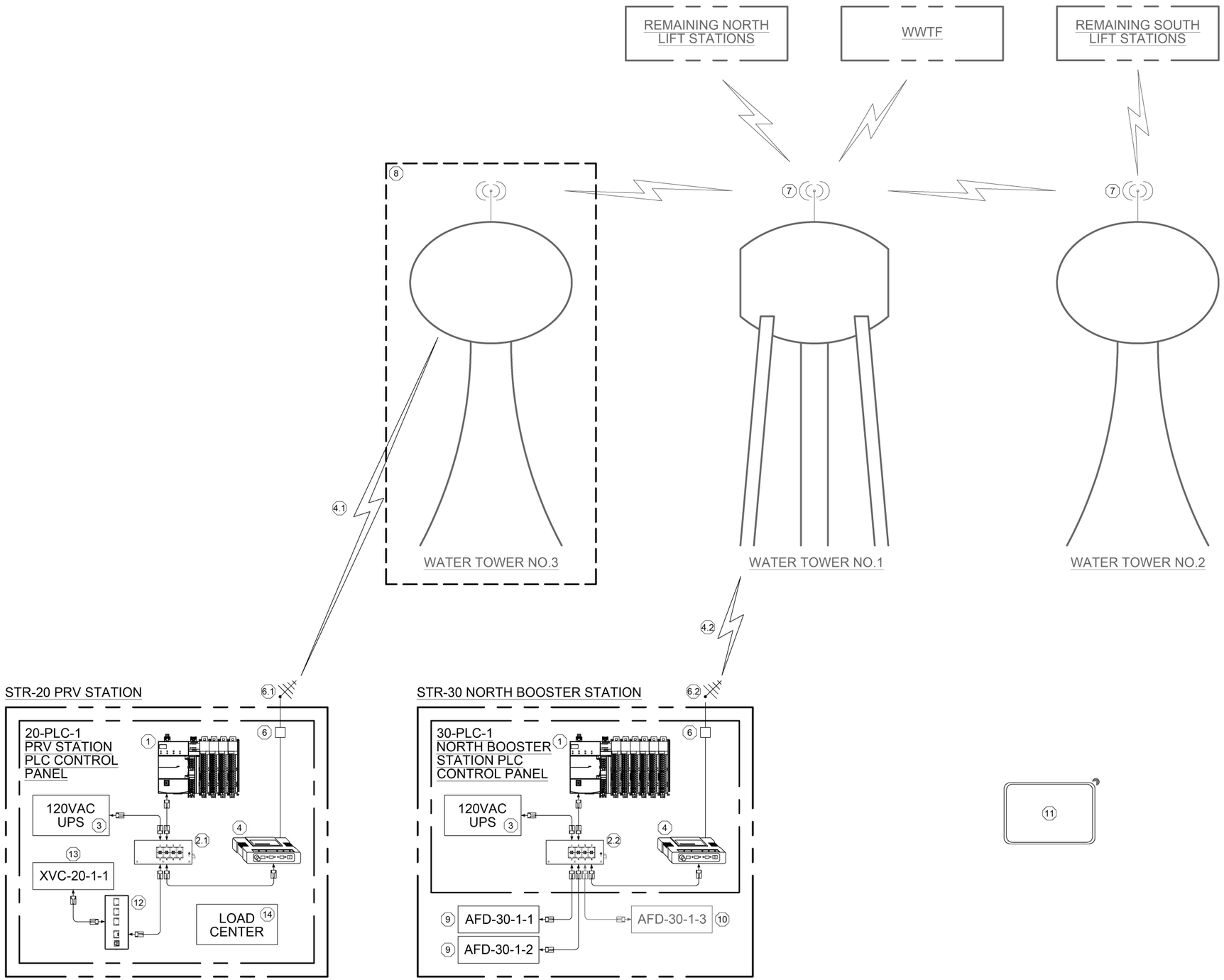
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
P&ID NO.2

PROJECT NO. 07985049.2
SHEET 06-N602

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GENERAL NOTES

A. REFER TO CONTROL PANEL I-O SCHEDULES FOR DETAILED MODULE REQUIREMENTS OF NEW PLC SYSTEMS.

B. CONTRACTOR SHALL BE RESPONSIBLE FOR DOCUMENTING AND LABELING ALL COMMUNICATIONS SYSTEM CABLING.

C. CONTRACTOR SHALL CONFIGURE ALL ETHERNET SWITCHING EQUIPMENT TO PROVIDE ACCEPTABLE NETWORK PERFORMANCE, INCLUDING THE MANAGING OF ALL SWITCHES AND DEVELOPMENT OF VLAN'S WHERE REQUIRED.

D. PROVIDE ALL REQUIRED UTP AND STP PATCH CABLES AS SPECIFIED.

E. PROVIDE ALL REQUIRED SERIAL, USB, VIDEO, AND OTHER INTERFACE CABLE AS REQUIRED FOR THE APPLICATION.

F. CONTRACTOR SHALL CONFIGURE NETWORK WITH NEW, UNIQUE PASSWORDS FOR ALL DEVICES AND OPERATORS.

G. CONTRACTOR SHALL CONFIGURE FIREWALL WITH FIP SECURITY BEST PRACTICES FOR SCADA SYSTEMS.

H. CONTRACTOR SHALL UPDATE MASTER AND ANY REDUNDANT SCADA SYSTEM PANEL AND/OR COMPUTER WITH NEW FUNCTIONALITY AS SHOWN AND AS SPECIFIED.

KEY NOTES (X)

1. PROVIDE TYPE I PROGRAMMABLE LOGIC CONTROLLER SYSTEM. REFER TO SPECIFICATIONS.
2. UNMANAGED ETHERNET SWITCH:
   - 2.1. PROVIDE 108TX - (8) 10/100 COPPER PORTS.
   - 2.2. PROVIDE 108TX - (8) 10/100 COPPER PORTS. RESERVE ONE PORT SPACE FOR FUTURE CHLORINE ANALYZER.
3. PROVIDE 120VAC UNINTERRUPTIBLE POWER SUPPLY - DOUBLE CONVERSION TYPE. 120VAC UPS SHALL BE LOCATED INSIDE OF THE PLC CONTROL PANEL.
4. PROVIDE RADIO COMPATIBLE WITH THE NEW SYSTEM BEING INSTALLED.
   - 4.1. STR-20 RADIO COMMUNICATES WITH FUTURE RADIO INFRASTRUCTURE AT FUTURE WATER TOWER NO.3.
   - 4.2. STR-30 RADIO COMMUNICATES WITH EXISTING RADIO INFRASTRUCTURE AT WATER TOWER NO.1.
5. PROVIDE ANTENNA CABLE, SURGE ARRESTERS, AND ATTENUATORS (WHERE REQUIRED).
6. PROVIDE YAGI-DIRECTIONAL ANTENNA:
   - 6.1. INSTALL ANTENNA PER DETAIL 2690-701 AND 2690-702. ANTENNA INSTALLATION SHALL NOT INTERFERE WITH OPENING ENCLOSURE COVER.
   - 6.2. INSTALL ANTENNA PER DETAIL 2690-700 AND 2690-701.
7. EXISTING RADIO EQUIPMENT AT EXISTING STRUCTURE TO REMAIN.
8. WATER TOWER NO.3 AND ASSOCIATED SYSTEM INTEGRATION WORK IS PROVIDED UNDER A SEPARATE CONTRACT. SCADA SYSTEM FUNCTIONALITY PROVIDED UNDER THIS CONTRACT SHALL BE INTEGRATED WITH BOTH THE EXISTING SCADA SYSTEM AND THE FUTURE SYSTEM AT WATER TOWER NO.3 AS SHOWN AND AS SPECIFIED.
9. WALL-MOUNTED AFD AS SPECIFIED.
10. FUTURE WALL-MOUNTED AFD.
11. PROVIDE WI-FI / CELLULAR CAPABLE TABLET CONFIGURED FOR REMOTE ACCESS INTO EXISTING SCADA SYSTEM.
12. PROVIDE PROTOCOL CONVERTER - RED LION DA10D, OR EQUAL. CONFIGURE PROTOCOL CONVERTER FOR MODBUS TCP TO ETHERNET/IP COMMUNICATIONS.
13. MANUFACTURER PROVIDED CONTROLLER - INTERFACE WITH SCADA SYSTEM AS SHOWN.
14. PLC CONTROL PANEL CONTAINS INTEGRAL LOAD CENTER. REFER TO ONE-LINES AND PANEL SCHEDULES.

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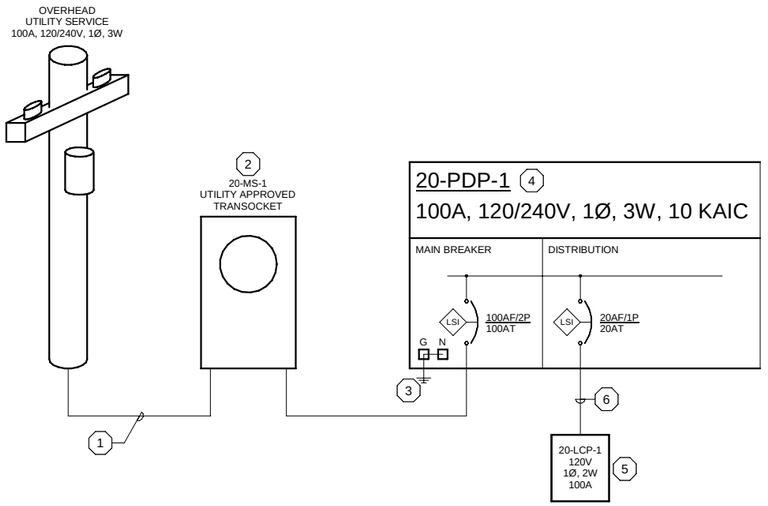
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

SCADA SYSTEM NETWORK ARCHITECTURE

PROJECT NO. 07985049.2
SHEET 06-N603



PRV STATION ONE-LINE

NTS

GENERAL NOTES

A. CIRCUIT BREAKER / ELECTRONIC TRIP UNITS SHALL BE PROVIDED WITH THE FOLLOWING FUNCTIONS WHERE SO INDICATED:
   a. "LSI" INDICATES ELECTRONIC TRIP WITH ADJUSTABLE LONG, SHORT, AND INSTANTANEOUS SETTINGS.

B. SEE "ONE-LINE DIAGRAM WIRING REQUIREMENTS" ON THIS DRAWING FOR NEW FEEDER AND BRANCH CIRCUIT WIRING REQUIREMENTS.

C. FEEDER SCHEDULE WIRING NOTATION IS SHOWN AS PHASE CONDUCTORS, NEUTRAL CONDUCTOR (WHERE REQUIRED), AND GROUND CONDUCTOR. WHERE MULTIPLE RUNS OF CONDUCTORS ARE INDICATED PROVIDE CONDUIT FOR EACH RUN.

D. FAULT CURRENTS INDICATED ARE ESTIMATED MAXIMUM AVAILABLE CURRENTS BASED ON DESIGN CONDITIONS. ACTUAL RATINGS SHALL BE DETERMINED BY THE SPECIFIED SYSTEM ANALYSIS STUDY.

E. THE PRIMARY OVERCURRENT PROTECTIVE DEVICES AND ASSOCIATED FEEDER CONDUCTORS FOR DRY TYPE TRANSFORMERS SHOWN ON THIS DRAWING ARE SIZED FOR 250% OF THE TRANSFORMER NAMEPLATE PRIMARY CURRENT. IF THE CONTRACTOR ELECTS TO SUPPLY TRANSFORMERS THAT REQUIRE LOWER RATED PRIMARY OVERCURRENT PROTECTIVE DEVICES TO ACCOUNT FOR LOWER INRUSH HARACTERISTICS, THEN THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING OVERCURRENT PROTECTIVE DEVICES AND FEEDERS THAT COMPLY WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS. REFER TO SPECIFICATIONS.

F. REFER TO PANEL SCHEDULES FOR ADDITIONAL BRANCH CIRCUIT REQUIREMENTS NOT SHOWN ON PROPOSED OVERALL ONE-LINE DIAGRAM.

KEY NOTES ⓧ

1 PROVIDE CONDUIT AND CONDUCTORS FROM UTILITY POLE MOUNTED TRANSFORMER SECONDARY TERMINALS TO TRANSOCKET.

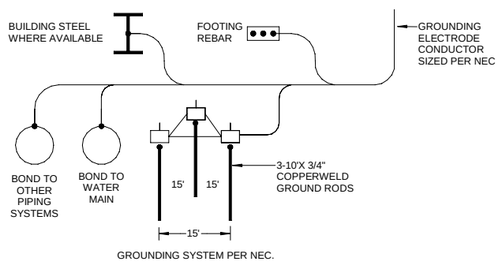
2 PROVIDE UTILITY APPROVED METER SOCKET WITH A LEVER ACTUATED POSITIVE BYPASS MECHANISM. SOCKET SHALL BE RATED FOR 200A MINIMUM. PROVIDE PROTECTIVE SHIELD FOR METER SOCKET IF METER SOCKET IS NOT PROTECTED BY A ROOF OVERHANG.

3 PROVIDE NEW GROUNDING IN ACCORDANCE WITH NEC. SEE DETAIL ON THIS SHEET.

4 20-PDP-1 IS A SERVICE ENTRANCE RATED INTEGRAL LOAD CENTER WITHIN 20-PLC-1. PROVIDE SQUARE D NQ OR EQUIVALENT TYPE PANEL. REFER TO 20-CE101 AND PANEL SCHEDULES FOR LOAD CENTER REQUIREMENTS.

5 PROVIDE NEMA 12 SCADA CONTROL PANEL AS SCHEDULED AND AS SHOWN ON DRAWINGS. CONTROL PANEL SHALL HAVE AN INTEGRAL LOAD CENTER.

6 REFER TO ELECTRICAL INSTALLATION AND WIRING SCHEDULES FOR THE CIRCUIT REQUIREMENTS OF THIS FEEDER.



GROUNDING ELECTRODE, CONDUCTOR AND BONDING REQUIREMENTS

NTS

STR-20 ONE-LINE DIAGRAM WIRING REQUIREMENTS

LOAD	SOURCE	FEEDER CIRCUIT		FEEDER CIRCUIT WIRING			NOTES
		VOLTAGE	RATING	WIRE SIZE	CONDUIT SIZE	CONDUCTOR MATERIAL	
20-MS-1	UTILITY TRANSFORMER	240 V	100 A / 2 P	2-#3, 1-#3, 1-#8	1"	Copper Conductor w/Neutral	1,2
20-PDP-1	20-MS-1	240 V	100 A / 2 P	2-#3, 1-#3, 1-#8	1"	Copper Conductor w/Neutral	1

GENERAL NOTES

A. REFER TO WIRNIG SCHEDULES FOR ADDITIONAL WIRING REQUIREMENTS.

SCHEDULE NOTES

1. CONDUIT SIZE LISTED IS MINIMUM INTERIOR OR EXTERIOR ABOVE GRADE CONDUIT SIZE. FOR MINIMUM UNDERGROUND CONDUIT SIZE, REFER TO ELECTRICAL PLANS.
2. COORDINATE WITH UTILITY FOR CONDUIT REQUIREMENTS.

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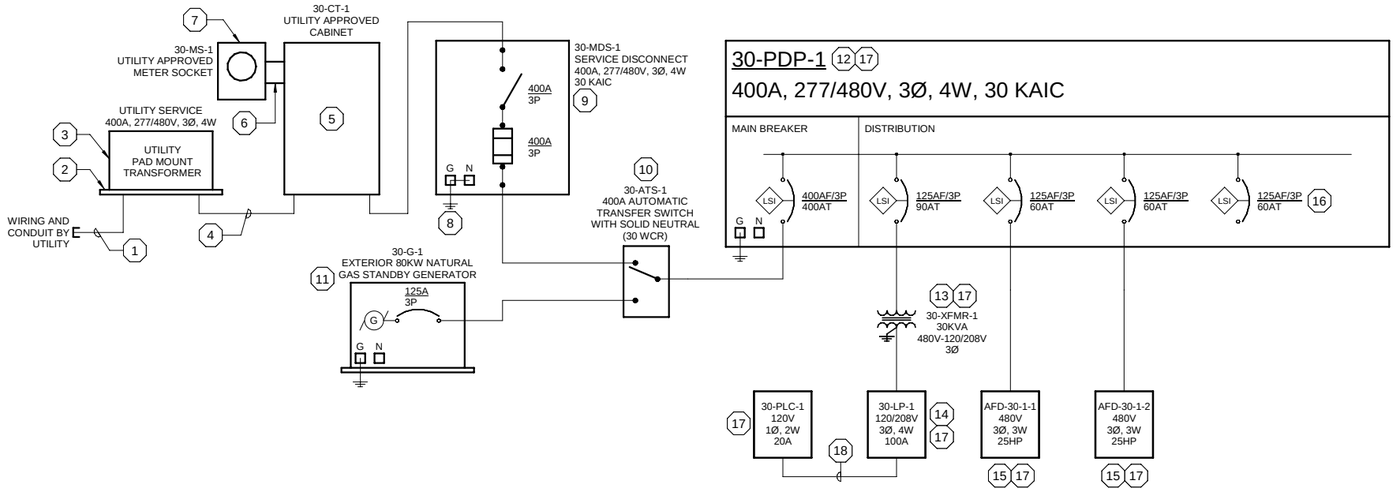
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PRV STATION ONE-LINE

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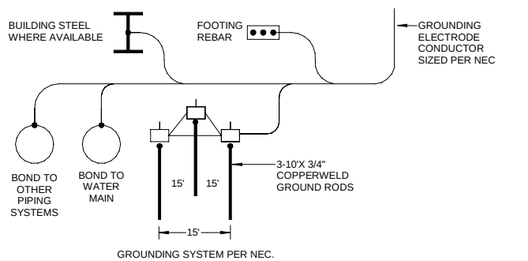
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NORTH BOOSTER STATION ONE-LINE

NTS



GROUNDING ELECTRODE, CONDUCTOR AND BONDING REQUIREMENTS

NTS

STR-30 ONE-LINE DIAGRAM WIRING REQUIREMENTS

LOAD	SOURCE	FEEDER CIRCUIT VOLTAGE	FEEDER CIRCUIT RATING	FEEDER CIRCUIT WIRING WIRE SIZE	CONDUIT SIZE	CONDUCTOR MATERIAL	NOTES
30-CT-1	UTILITY TRANSFORMER	480 V	400 A / 3 P	3-#600, 1-#600, 1-#3	4"	Copper Conductor w/Neutral	1,2
30-MDS-1	30-CT-1	480 V	400 A / 3 P	3-#600, 1-#600, 1-#3	4"	Copper Conductor w/Neutral	
30-ATS-1 (NORMAL)	30-MDS-1	480 V	400 A / 3 P	3-#600, 1-#600, 1-#3	4"	Copper Conductor w/Neutral	
30-G-1	30-ATS-1 (EMERGENCY)	480 V	125 A / 3 P	3-#1, 1-#1, 1-#6	1 1/2"	Copper Conductor w/Neutral	1
30-PDP-1	30-ATS-1 (LOAD)	480 V	400 A / 3 P	3-#600, 1-#600, 1-#3	4"	Copper Conductor w/Neutral	
AFD-30-1-1	30-PDP-1	480 V	60 A / 3 P	3-#8, 1-#8	1"	Copper Conductor w/o Neutral	
AFD-30-1-2	30-PDP-1	480 V	60 A / 3 P	3-#8, 1-#8	1"	Copper Conductor w/o Neutral	
30-XMFR-1	30-PDP-1	480 V	90 A / 3 P	3-#3, 1-#8	3/4"	Copper Conductor w/o Neutral	
30-LP-1	30-XMFR-1	208 V	100 A / 3 P	3-#3, 1-#3, 1-#8	1 1/4"	Copper Conductor w/Neutral	

GENERAL NOTES

A. REFER TO WIRNIG SCHEDULES FOR ADDITIONAL WIRING REQUIREMENTS.

SCHEDULE NOTES

1. CONDUIT SIZE LISTED IS MINIMUM INTERIOR OR EXTERIOR ABOVE GRADE CONDUIT SIZE. FOR MINIMUM UNDERGROUND CONDUIT SIZE, REFER TO ELECTRICAL PLANS.
2. COORDINATE WITH UTILITY FOR CONDUIT REQUIREMENTS.

GENERAL NOTES

A. CIRCUIT BREAKER / ELECTRONIC TRIP UNITS SHALL BE PROVIDED WITH THE FOLLOWING FUNCTIONS WHERE SO INDICATED:
   a. "LSI" INDICATES ELECTRONIC TRIP WITH ADJUSTABLE LONG, SHORT, AND INSTANTANEOUS SETTINGS.

B. SEE "ONE-LINE DIAGRAM WIRING REQUIREMENTS" ON THIS DRAWING FOR NEW FEEDER AND BRANCH CIRCUIT WIRING REQUIREMENTS.

C. FEEDER SCHEDULE WIRING NOTATION IS SHOWN AS PHASE CONDUCTORS, NEUTRAL CONDUCTOR (WHERE REQUIRED), AND GROUND CONDUCTOR. WHERE MULTIPLE RUNS OF CONDUCTORS ARE INDICATED PROVIDE CONDUIT FOR EACH RUN.

D. FAULT CURRENTS INDICATED ARE ESTIMATED MAXIMUM AVAILABLE CURRENTS BASED ON DESIGN CONDITIONS. ACTUAL RATINGS SHALL BE DETERMINED BY THE SPECIFIED SYSTEM ANALYSIS STUDY.

E. THE PRIMARY OVERCURRENT PROTECTIVE DEVICES AND ASSOCIATED FEEDER CONDUCTORS FOR DRY TYPE TRANSFORMERS SHOWN ON THIS DRAWING ARE SIZED FOR 250% OF THE TRANSFORMER NAMEPLATE PRIMARY CURRENT. IF THE CONTRACTOR ELECTS TO SUPPLY TRANSFORMERS THAT REQUIRE LOWER RATED PRIMARY OVERCURRENT PROTECTIVE DEVICES TO ACCOUNT FOR LOWER INRUSH HARACTERISTICS, THEN THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING OVERCURRENT PROTECTIVE DEVICES AND FEEDERS THAT COMPLY WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS. REFER TO SPECIFICATIONS.

F. REFER TO PANEL SCHEDULES FOR ADDITIONAL BRANCH CIRCUIT REQUIREMENTS NOT SHOWN ON PROPOSED OVERALL ONE-LINE DIAGRAM.

KEY NOTES (X)

1 PRIMARY CONDUCTORS PROVIDED, INSTALLED, AND TERMINATED BY UTILITY.
2 PROVIDE PAD FOR PAD MOUNT TRANSFORMER. COORDINATE PAD REQUIREMENTS WITH UTILITY.
3 UTILITY PAD MOUNTED TRANSFORMER FURNISHED, INSTALLED, AND TERMINATED BY UTILITY.
4 PROVIDE CONDUIT AND CONDUCTORS FROM PAD MOUNT TRANSFORMER SECONDARY TERMINALS TO INSTRUMENT TRANSFORMER COMPARTMENT. UTILITY TO MAKE TERMINATIONS AND CONNECTIONS TO THE TRANSFORMER.
5 PROVIDE UTILITY APPROVED NEMA 4X INSTRUMENT TRANSFORMER CABINET. UTILITY SHALL FURNISH CT AND PT TRANSFORMERS.
6 PROVIDE 1" METERING CONDUIT FROM THE INSTRUMENT TRANSFORMER CABINET TO THE METER SOCKET.
7 UTILITY TO FURNISH METER SOCKET. CONTRACTOR SHALL INSTALL PER UTILITY REQUIREMENTS.
8 PROVIDE NEW GROUNDING IN ACCORDANCE WITH NEC. SEE DETAIL ON THIS SHEET.
9 PROVIDE SERVICE ENTRANCE RATED NEMA 3R FUSED DISCONNECT SWITCH.
10 PROVIDE NEMA 12 AUTOMATIC TRANSFER SWITCH.
11 NATURAL GAS FUELED STANDBY ENGINE GENERATOR PER DETAIL 2632-301. PROVIDE FUEL PIPING, AND NORMAL AND EMERGENCY VENT PIPING AS REQUIRED TO MEET ALL APPLICABLE NFPA REQUIREMENTS.
12 PROVIDE NEMA 12 POWER DISTRIBUTION PANEL AS SCHEDULED AND AS SHOWN ON DRAWINGS.
13 PROVIDE NEMA 12 FLOOR MOUNTED TRANSFORMER.
14 PROVIDE NEMA 12 LIGHTING PANEL AS SCHEDULED AND AS SHOWN ON DRAWINGS.
15 PROVIDE WALL MOUNTED NEMA 12 AFD. REFER TO ELECTRICAL PLANS AND SPECIFICATIONS.
16 PROVIDE SPARE BREAKER IN 30-PDP-1 FOR FUTURE AFD.
17 BUILDING WALL SPACE IS LIMITED. REFER TO 30-E101 FOR SPACE REQUIREMENTS AND SPECIFICATIONS FOR CONTROL PANEL SIZES.
18 REFER TO ELECTRICAL INSTALLATION AND WIRING SCHEDULES FOR THE CIRCUIT REQUIREMENTS OF THIS FEEDER.

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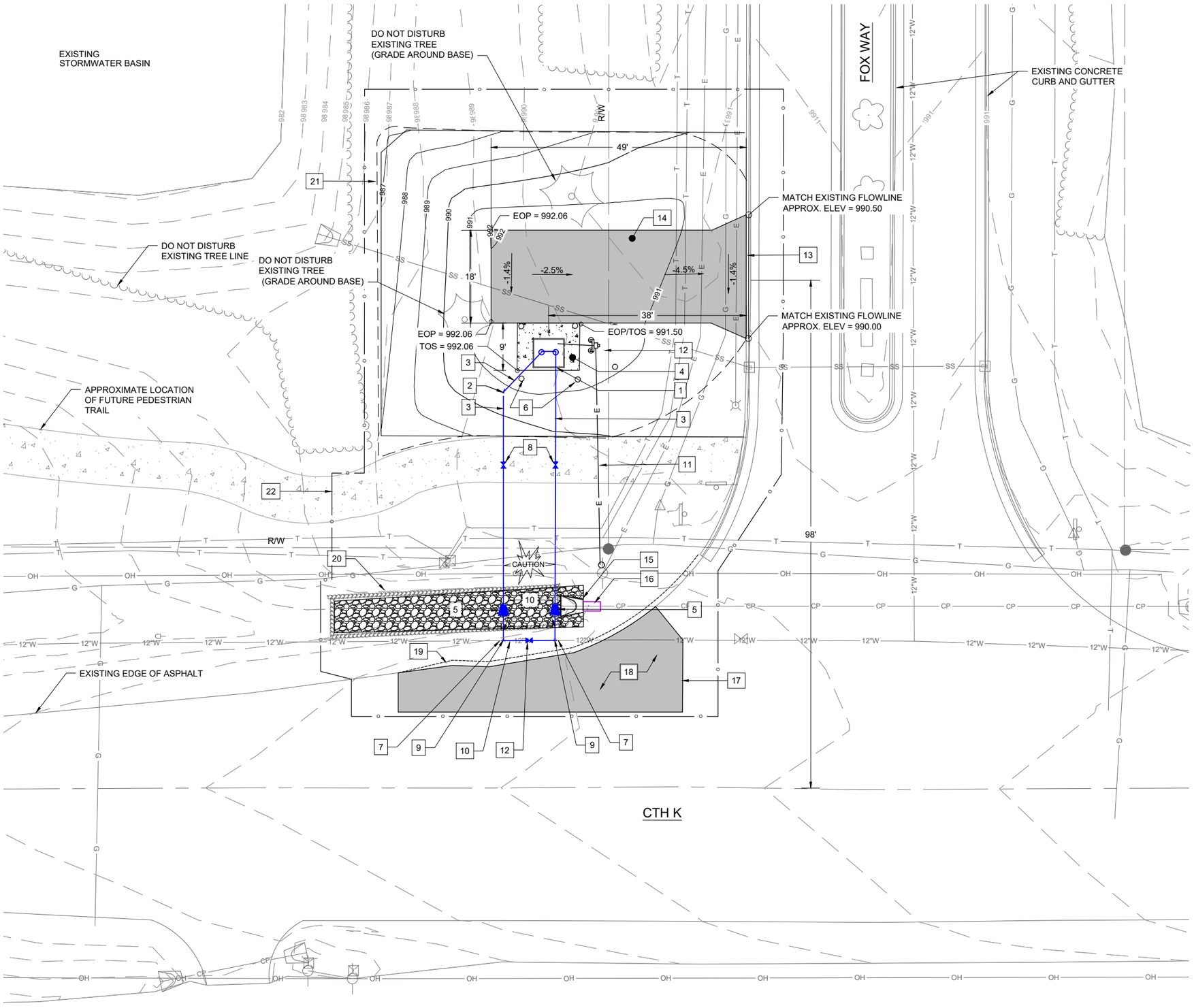
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NORTH BOOSTER STATION ONE-LINE

PROJECT NO. 07985049.2
SHEET 07-E602



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GENERAL NOTES

A. CONSTRUCTION DISTURBANCE, INCLUDING STAGING, STOCK PILING, AND CONSTRUCTING SHALL BE CONTAINED WITHIN THE CONSTRUCTION LIMITS IDENTIFIED ON THIS SHEET.

B. REFER TO MECHANICAL SHEETS FOR ENCLOSURE AND PIPING INFORMATION.

C. REFER TO ELECTRICAL SHEETS FOR SITE ELECTRICAL INFORMATION

D. EXISTING TOPSOIL WITHIN THE ANTICIPATED DISTURBANCE LIMITS OF THE PROPOSED WORK SHALL BE STRIPPED,SALVAGED, AND STOCKPILED (ONSITE) TO BE USED FOR FINAL RESTORATION OF THE SITE.

E. TOPSOIL (VIRGIN AND SALVAGED) SHALL BE A MIN. OF 4-INCHES THICK FOR FINAL RESTORATION.

F. ALL DISTURBED AREAS, UNLESS OTHERWISED SURFACED, SHALL BE RESTORED WILL TOPSOIL, SEED, FERTILIZER, AND MULCH

KEY NOTES

1. PACKAGED PRESSURE REDUCING VALVE STATION - SEE MECHANICAL SHEETS
2. 8" DUCTILE IRON BEND
3. 8" DUCTILE IRON WATER MAIN
4. 3' WIDE CONCRETE PAVEMENT ON EAST, WEST, AND NORTH SIDES OF PACKAGED PRV STATION. PROVIDE BOND BREAKER ALONG PRV ENCLOSURE STRUCTURE
5. 12" X 8" REDUCER
6. PIPE BOLLARD, TYP. OF FOUR (4)
7. 12" X 12" TEE
8. 8" VALVE & BOX
9. CONNECT TO EXISTING WATER MAIN
10. 12" DUCTILE IRON WATER MAIN
11. UNDERGROUND ELECTRICAL CONDUIT, REFER TO ELECTRICAL PLANS
12. ELECTRICAL EQUIPMENT RACK & METER SOCKET, REFER TO ELECTRICAL SITE PLAN
13. CUT EXISTING CURB HEAD FOR DRIVEWAY OPENING
14. ASPHALT DRIVEWAY, SEE DETAIL
15. REMOVE AND REPLACE EXISTING CULVERT ENDWALL - MATCH EXISTING PIPE DIAMETER AND MATERIAL
16. REMOVE AND REPLACE PIPE AS REQUIRED FOR WATER MAIN INSTALLATION. SAWCUT CLEAN EDGE ON EXISTING PIPE. REFER TO STORM SEWER CONNECTION DETAIL (SHEET 05-C504)
17. SAWCUT AND MATCH EXISTING ASPHALT PAVEMENT
18. REPLACE EXISTING ASPHALT PAVEMENT, SEE DETAIL. REFER TO TEMPORARY TRAFFIC CONTROL PLANSHEET FOR TRAFFIC CONTROL STAGING.
19. 1-FOOT WIDE AGGREGATE SHOULDER, INSTALL FULL LENGTH OF ASPHALT REPLACEMENT
20. REMOVE AND REPLACE EXISTING MEDIUM RIPRAP, REINSTALL WITH GEOTEXTILE FABRIC, TYP.
21. SLOPE INTERCEPT OF FILLED AREA. ALL OTHER DISTURBED AREAS SHALL MATCH EXISTING ELEVATIONS AND SLOPES.
22. CONSTRUCTION LIMITS, TYP.
23. 12" VALVE & BOX

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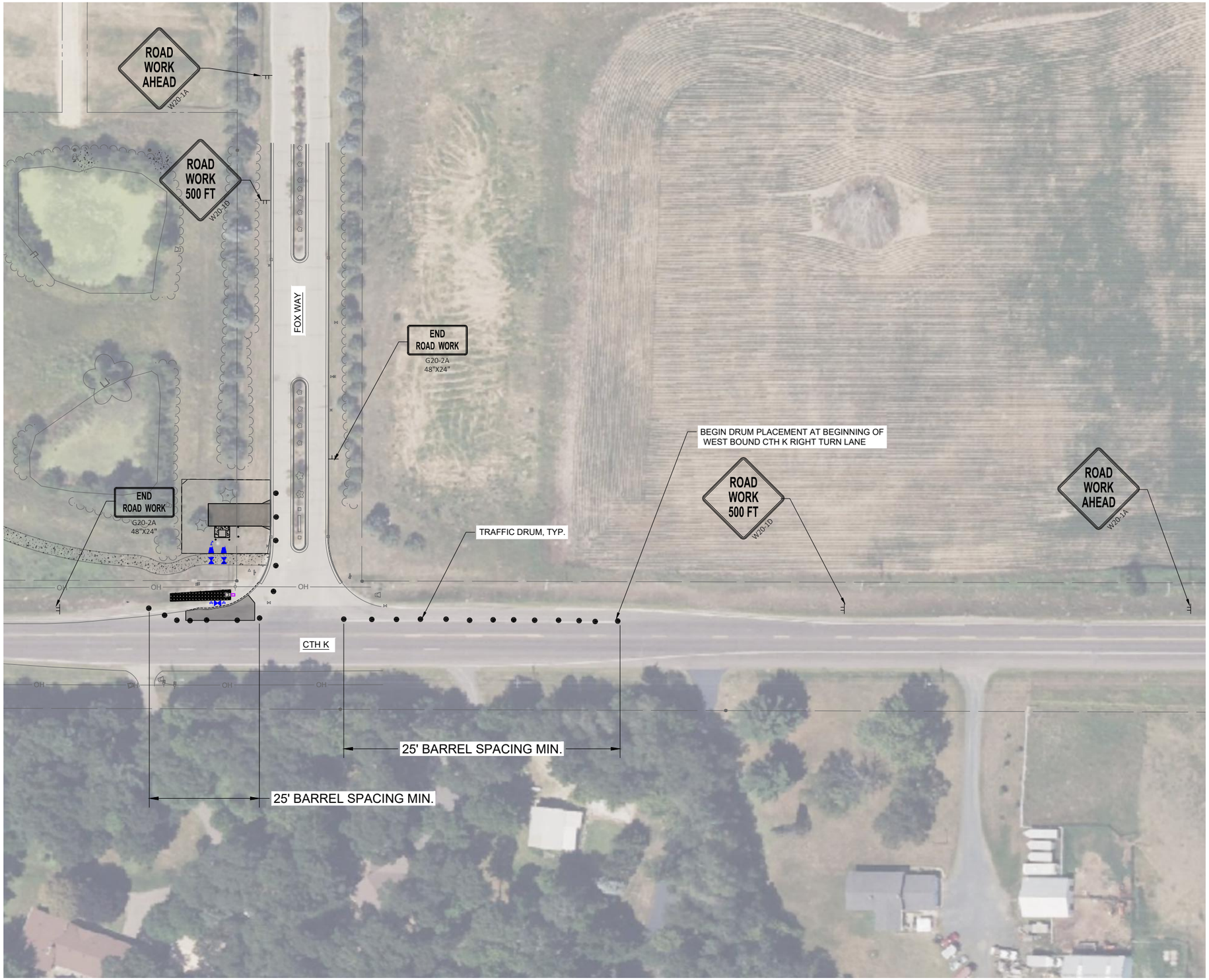
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PRESSURE REDUCING VALVE STATION SITE, UTILITY, AND GRADING PLAN

PROJECT NO. 07985049.2
SHEET 20-C101



0 40 80

GENERAL NOTES

A. TRAFFIC CONTROL SHOWN IS THE MINIMUM REQUIRED. THE CONTRACTOR IS REQUIRED TO PROVIDE AND CONDUCT A SAFE ENVIRONMENT FOR WORKERS, PEDESTRIANS, AND ROADWAY USERS.

B. THE CONTRACTOR SHALL ADD ADDITIONAL TRAFFIC CONTROL MEASURES AS DIRECTED BY THE ENGINEER OR OWNER.

C. THE CONTRACTOR MAY SUBSTITUTE THE USE OF DRUMS ALONG FOX WAY FOR HIGH VISIBILITY SAFETY FENCING.

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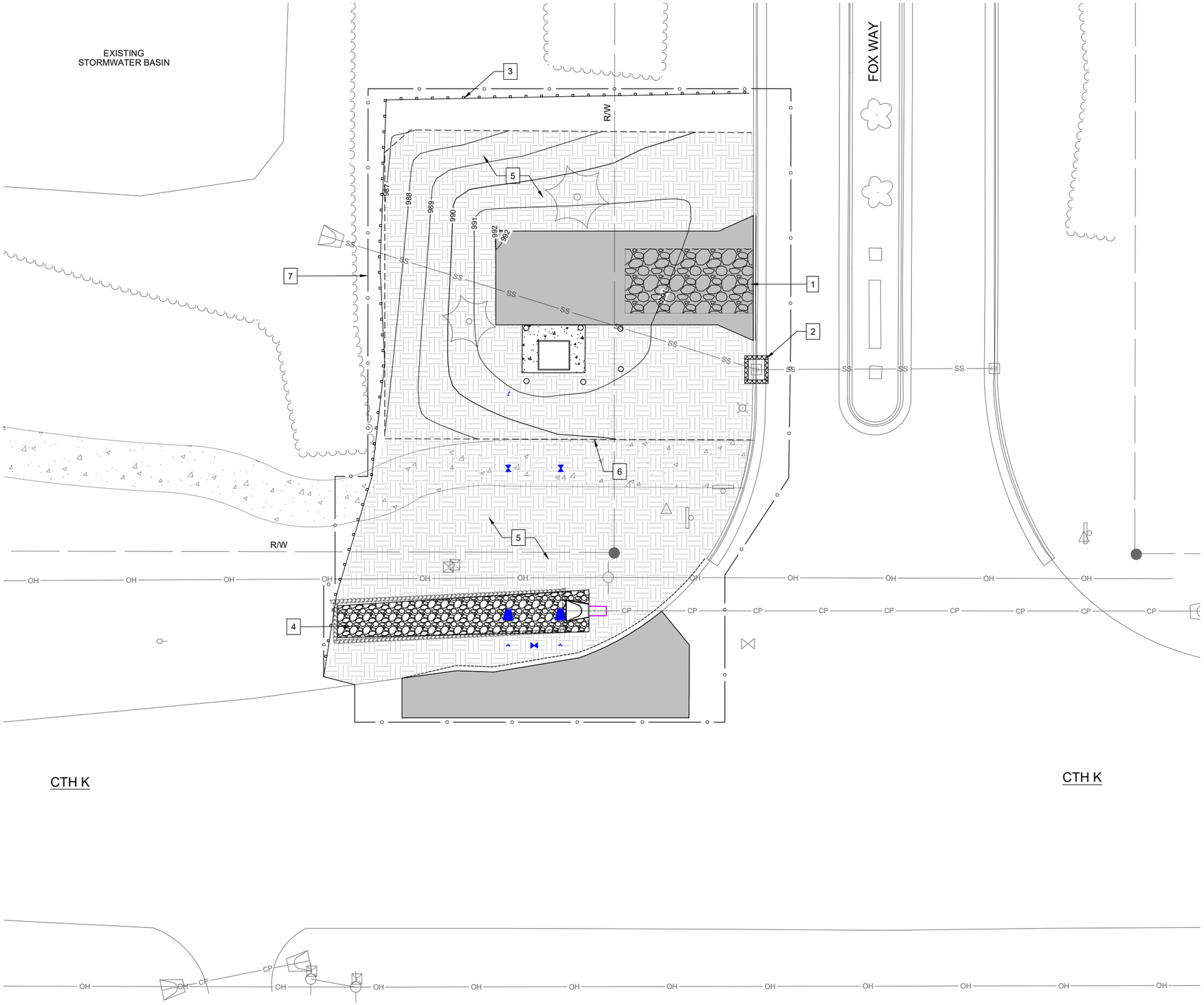
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PRESSURE REDUCING VALVE STATION
TEMPORARY TRAFFIC CONTROL PLAN

PROJECT NO. 07985049.2
SHEET 20-C102



GENERAL NOTES

A. ALL AREAS, UNLESS OTHERWISE SURFACED, SHALL RECEIVE TOPSOIL (SALVAGED AND/OR VIRGIN), SEED, FERTILIZER, AND MULCH.

B. EROSION CONTROL BMPS ARE THE MINIMUM REQUIRED. ADDITIONAL EROSION CONTROL ITEMS SHALL BE INSTALLED AS DIRECTED BY ENGINEER OR OWNER

C. ALL DISTURBED AREAS WITH SLOPES GREATER THAT 4:1 SHALL BE RESTORED WITH EROSION MAT, SEED, AND FERTILIZER.

KEY NOTES

1. TRACKING PAD AT SITE ENTRANCE, TYP.
2. INLET PROTECTION, TYPE C, TYP.
3. PERIMETER SILT FENCE, TYP.
4. REMOVE AND REPLACE EXISTING MEDIUM RIPRAP WITH FABRIC AT APRON ENDWALL, TYP.
5. RESTORE ALL DISTURBED AREAS WITH TOPSOIL (SALVAGED OR VIRGIN), SEED, FERTILIZER, AND MULCH (EROSION MAT OR HYDRO-SEED) UNLESS OTHERWISE NOTED.
6. SLOPE INTERCEPT, TYP.
7. CONSTRUCTION LIMITS, TYP.

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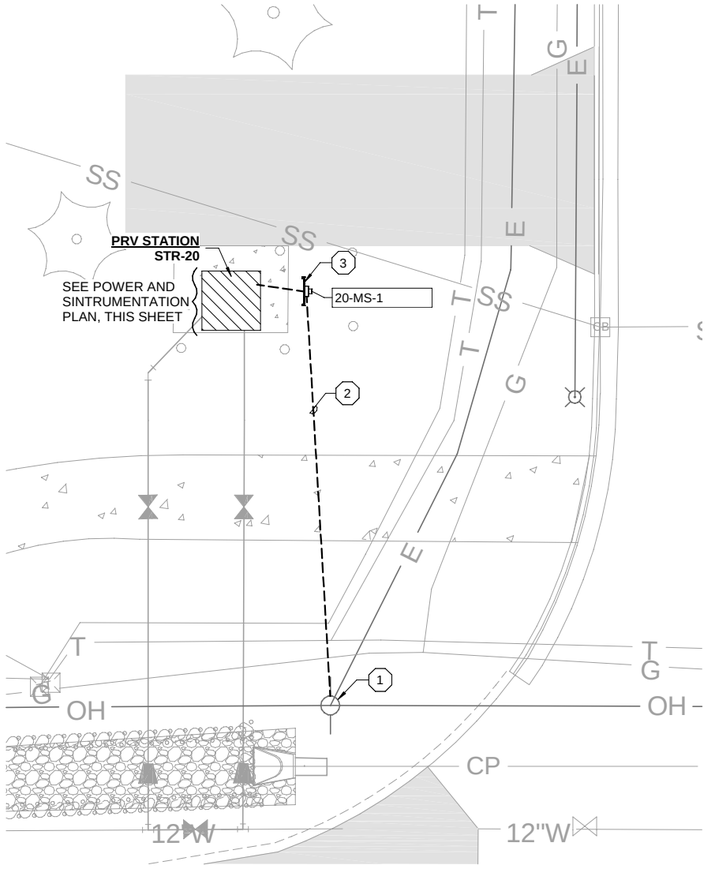
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

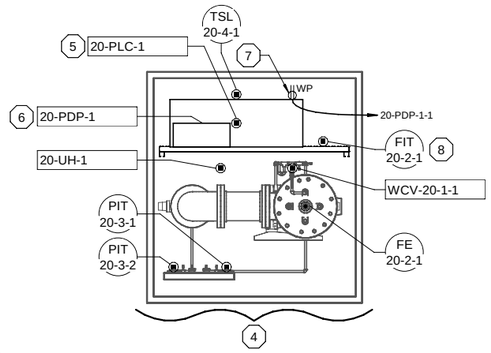
PRESSURE REDUCING VALVE STATION
EROSION CONTROL PLAN

PROJECT NO. 07985049.2
SHEET 20-C103



SITE PLAN

1/8" = 1'-0" (22" x 34")
1/16" = 1'-0" (11" x 17")
0 4 8 16



POWER AND INSTRUMENTATION PLAN

1/2" = 1'-0" (22" x 34")
1/4" = 1'-0" (11" x 17")
0 1 2 4

GENERAL NOTES

A. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER BEFORE CONTINUING WITH CONSTRUCTION.

B. ALL ELECTRICAL INSTALLATIONS SHALL MEET NEC REQUIREMENTS FOR MINIMUM WORKING SPACE IN FRONT OF EQUIPMENT AND DEDICATED EQUIPMENT SPACE ABOVE SWITCHBOARDS, SWITCHGEAR, PANELBOARDS AND MOTOR CONTROL CENTERS. COORDINATE LAYOUT OF ALL ELECTRICAL EQUIPMENT PRIOR TO INSTALLATION.

C. UNDERGROUND CONDUIT ROUTING IS DIAGRAMMATIC IN NATURE AND IS NOT INTENDED TO DICTATE EXACT ROUTING. CONTRACTOR IS TO DETERMINE BEST ROUTING BASED ON OTHER UTILITIES AND FIELD CONDITIONS.

D. DIRECT BURIED CONDUITS SHALL BE INSTALLED PER DETAIL 2605-310. PROVIDE SPACERS TO PHYSICALLY SEPARATE LOW VOLTAGE AND CONTROL CONDUITS FROM POWER CONDUITS. INSTALL PULL CORD IN ALL EMPTY CONDUITS. UNLESS SHOWN OTHERWISE, ALL CONDUITS SHALL BE BURIED 24" MINIMUM BELOW FINISHED GRADE.

E. PULL BOXES AND HANDHOLES SHALL BE INSTALLED PER DETAIL 2605-550. SIZE PULL BOXES AS REQUIRED FOR DUCT BANK. PROVIDE PULL BOXES AS REQUIRED FOR PULL LENGTH. PULL BOXES AND HANDHOLES INSTALLED WITHIN FIVE FEET OF PAVEMENT AREAS SHALL BE ANSI TIER 22 TRAFFIC RATED WITH EXTRA HEAVY-DUTY COVERS.

F. CONDUIT SHALL BE 3/4" MINIMUM OR AS NOTED OTHERWISE.

G. CONDUIT WALL AND FLOOR PENETRATIONS PER DETAILS 2605-303 AND 2605-305.

H. SEE ONE-LINE DIAGRAMS, PANEL SCHEDULES, AND ELECTRICAL INSTALLATION AND WIRING SCHEDULES FOR WIRING OF ALL FIELD INSTRUMENTATION AND EQUIPMENT.

I. INSTALL FIELD INSTRUMENTATION AND EQIUPMENT PER DETAIL REFERENCED IN ELECTRICAL INSTALLATION AND WIRING SCHEDULES.

J. SEE SCADA SYSTEM NETWORK ARCHITECTURE FOR COMMUNICATIONS CABLING REQUIREMENTS.

K. ROOM/AREA ATMOSPHERE REQUIREMENTS, REFER TO SECTION 26 05 00:
   a. PRV STATION SITE EXTERIOR: GENERAL, WET, NEW CONSTRUCTION
   b. PRV STATION SITE UNDERGROUND: UNDERGROUND CONSTRUCTION
   c. PRV STATION ENCLOSURE: GENERAL, DAMP, NEW CONSTRUCTION

KEY NOTES ⓧ

1 UTILITY POLE AND POLE-MOUNTED TRANSFORMER PROVIDED BY UTILITY.
2 PROVIDE (1) 2" DIRECT BURIED CONDUIT FOR ELECTRICAL SERVICE LATERAL CONDUCTORS TO RACK MOUNTED METERING EQUIPMENT. COORDINATE WITH UTILITY FOR CONDUIT REQUIREMENTS.
3 PROVIDE EQUIPMENT RACK PER DETAIL 2605-400. WIDTH SHALL BE LARGE ENOUGH TO ACCOMMODATE METER SOCKET.
4 REFER TO P&IDS AND PROCESS PLANS FOR PROCESS PIPING SECTION VIEWS.
5 MOUNT 20-PLC-1 HIGHER THAN PRV ENCLOSURE BASE TO PREVENT OBSTRUCTION OF THE PANEL AND TO ALLOW THE PANEL DOOR TO FULLY OPEN.
6 20-PDP-1 IS AN INTEGRAL LOAD CENTER TO 20-PLC-1.
7 CONVENIENCE RECEPTACLE FLUSH WITH SCADA CONTROL PANEL DOOR.
8 INSTALL FIT-20-2-1 PER DETAIL 2605-401. FIT-20-2-1 SHALL BE MOUNTED TO THE SAME RACK AS 20-PLC-1.

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PRV STATION
ELECTRICAL SITE PLAN

PROJECT NO. 07985049.2
SHEET 20-CE101

KEYNOTES:

1. PREFABRICATED INSULATED FIBERGLASS ENCLOSURE - BY STATION SUPPLIER
2. 8 INCH CLASS 52 FLANGED DUCTILE IRON PIPE
3. BI-DIRECTIONAL MAGNETIC FLOW METER - PROVIDED BY STATION SUPPLIER, SPECIFIED UNDER DIVISION 26
4. 8"X8"X8" FLANGED DUCTILE IRON TEE
5. BUTTERFLY VALVE, LUGGED STYLE, WITH LEVER HANDLE OPERATOR
6. PRESSURE AND FLOW CONTROL VALVE - SEE DIVISION 40 SPECIFICATIONS
7. PROVIDE 3/4-INCH NPT TAP AND COPPER PIPING TO PRESSURE MONITORING PANEL (TYP. OF 2)
8. 8" 90 DEGREE FLANGED DUCTILE IRON ELBOW
9. NOT USED.
10. PRESSURE MONITORING PANEL AND RACK. ALUMINUM RACK SHALL BE LARGE ENOUGH TO MOUNT THE FOLLOWING EQUIPMENT:
    - A. PRESSURE GAUGE (2)
    - B. SAMPLE TAP (2)
    - C. BALL VALVES (4)
    - D. ASSOCIATED COPPER PIPING
11. FLANGE ADAPTER (MEGA-FLANGE SERIES 2100 OR EQUAL)
12. PIPE SUPPORT (SADDLE TYPE)

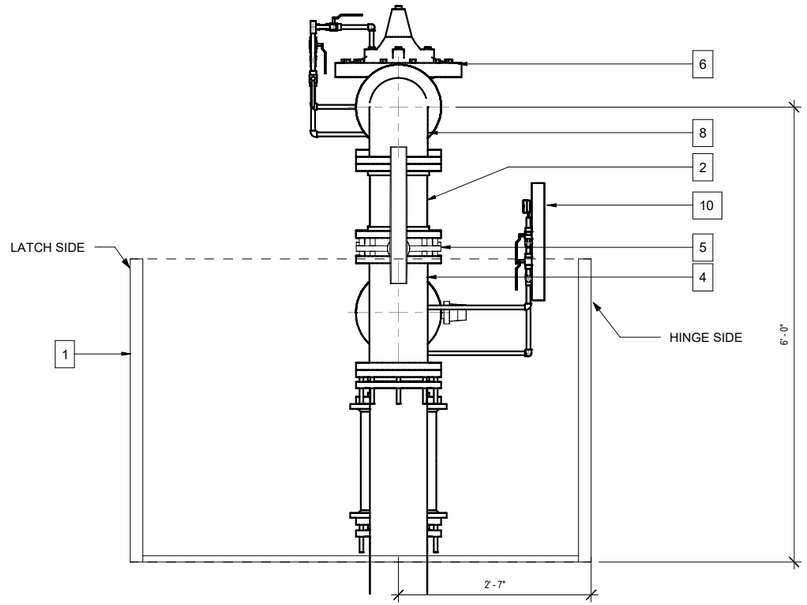
LEGEND

PROVIDED AND INSTALLED BY SITE UTILITY CONTRACTOR (OR GENERAL)

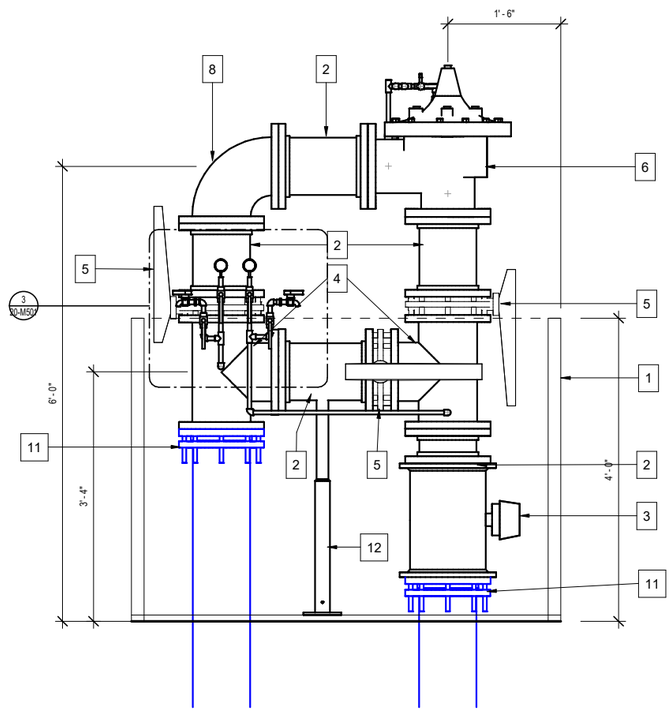
ASSEMBLED AND FURISHED BY PREFABRICATED STATION MANUFACTURER

GENERAL NOTES:

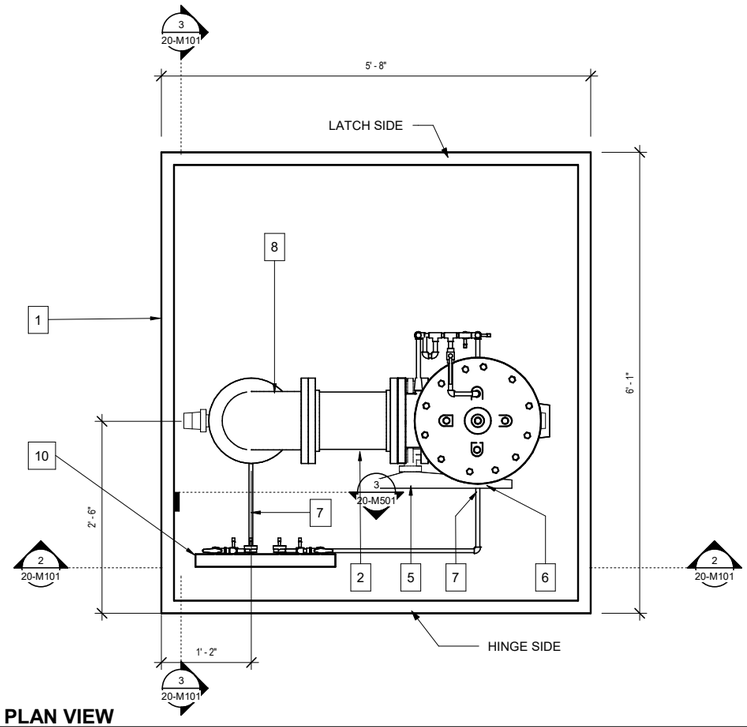
A. PIPING SHOWN AS FLANGED CLASS 52 DUCTILE IRON. MAY SUBSTITUTE STAINLESS OR SCH. 40 STEEL PIPING AS ALTERNATE.
B. FLANGED CONNECTION SHOWN ON DRAWINGS, PACKAGED PRESSURE REDUCING STATION SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER OR OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE WITH LEVER HANDLE OPERATORS.



3 **PROCESS PIPING SECTION**
20-M101 1" = 1'-0" (22"x34")



2 **PROCESS PIPING SECTION**
20-M101 1" = 1'-0" (22"x24") 0 6" 1' 2'
1/2" = 1'-0" (11"x17")



PLAN VIEW
1" = 1'-0" (22"x24") 0 6" 1' 2'
1/2" = 1'-0" (11"x17")

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WATER TOWER #3 AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PRESSURE REDUCING VALVE STATION PROCESS PLAN

PROJECT NO. 07985049.2
SHEET 20-M101

PLOT DATE: 11/17/2025 12:42:11 PM
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LEGEND

PROVIDED AND INSTALLED BY SITE UTILITY CONTRACTOR (OR GENERAL)

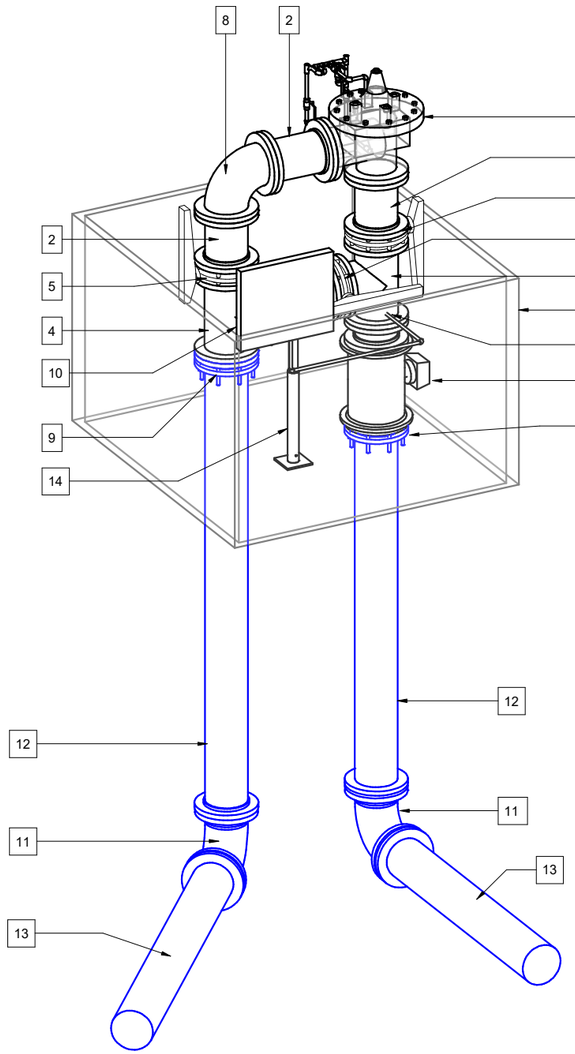
ASSEMBLED AND FURISHED BY PREFABRICATED STATION MANUFACTURER

GENERAL NOTES:

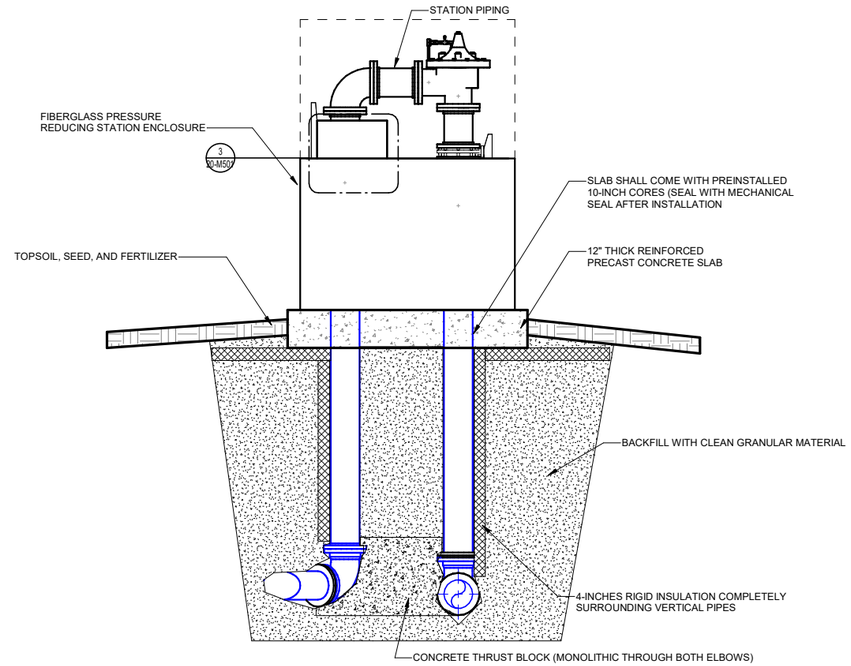
A. PIPING SHOWN AS FLANGED CLASS 52 DUCTILE IRON. MAY SUBSTITUTE STAINLESS OR SCH. 40 STEEL PIPING AS ALTERNATE.
B. FLANGED CONNECTION SHOWN ON DRAWINGS, PACKAGED PRESSURE REDUCING STATION SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER OR OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE WITH LEVER HANDLE OPERATORS.

KEYNOTES:

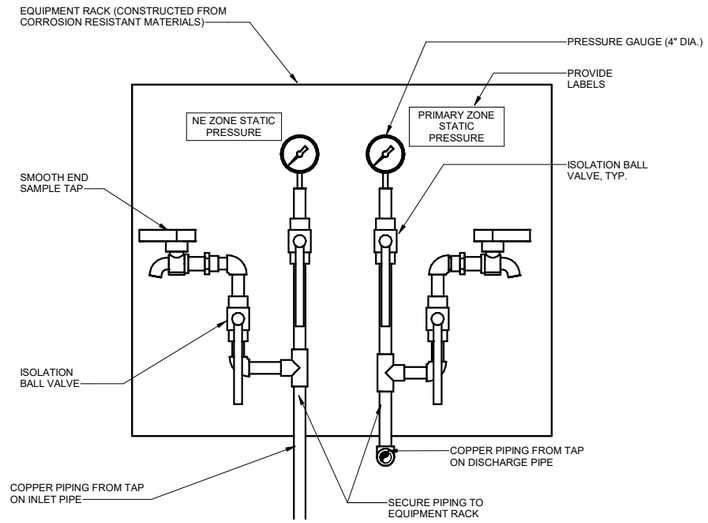
1. PREFABRICATED INSULATED FIBERGLASS ENCLOSURE - BY STATION SUPPLIER
2. 8 INCH CLASS 53 FLANGED DUCTILE IRON PIPE
3. BI-DIRECTIONAL MAGNETIC FLOW METER - PROVIDED BY STATION SUPPLIER, SPECIFIED UNDER DIVISION 26
4. 8"X8"X8" FLANGED DUCTILE IRON TEE
5. BUTTERFLY VALVE, LUGGED STYLE, WITH LEVER HANDLE OPERATOR
6. PRESSURE AND FLOW CONTROL VALVE - SEE DIVISION 40 SPECIFICATIONS
7. PROVIDE 3/4-INCH NPT TAP AND COPPER PIPING TO PRESSURE MONITORING PANEL (TYP. OF 2)
8. 8" 90 DEGREE FLANGED DUCTILE IRON ELBOW
9. FLANGE APAPTER (SERIES 2100 OR EQUAL MEGA-FLANGE)
10. PRESSURE MONITORING PANEL AND RACK. ALUMINUM RACK SHALL BE LARGE ENOUGH TO MOUNT THE FOLLOWING EQUIPMENT:
    A. PRESSURE GAUGE (2)
    B. SAMPLE TAP (2)
    C. BALL VALVES (4)
    D. ASSOCIATED COPPER PIPING
11. 8" 90 DEGREE MECHANICAL JOINT DUCTILE IRON ELBOW. PROVIDE MEGA-LUG JOINT RESTRAIN, SEE SITE PLAN
12. 8 INCH DUCTILE IRON PIPE (MJxPE)
13. 8 INCH DUCTILE IRON PIPE (BY SITE UTILITY CONTRACTOR)
14. PIPE SUPPORT (SADDLE TYPE)



1 PROCESS PIPING ISOMETRIC
20-M501 NOT TO SCALE



2 INSTALLATION DETAIL
20-M501 NOT TO SCALE



GENERAL NOTES:
A. EQUIPMENT RACK SHALL BE CONSTRUCTED FROM CORROSION RESISTANT MATERIALS (STAINLESS STEEL, GALVANIZED STEEL, OR ALUMINUM).
B. THE CONTRACTOR OR SUPPLIER MAY SUBSTITUTE STAINLESS STEEL PIPING.
C. BALL VALVES SHALL BE STAINLESS STEEL OR LEAD FREE BRONZE.
D. PRESSURE GAUGES SHALL HAVE A MINIMUM DIAMETER OF 4 INCHES.
E. SAMPLE TAP SHALL HAVE A SMOOTH BORE AND A MINIMUM DIAMTER OF 3/4 INCHES.
F. RACK SHALL BE MOUNTED TO PRV ENCLOSURE FRAMING OR UNISTRUT STRUCTURE SECURED TO FLOOR.

3 PRESSURE MONITORING RACK DETAIL
20-M501 NOT TO SCALE

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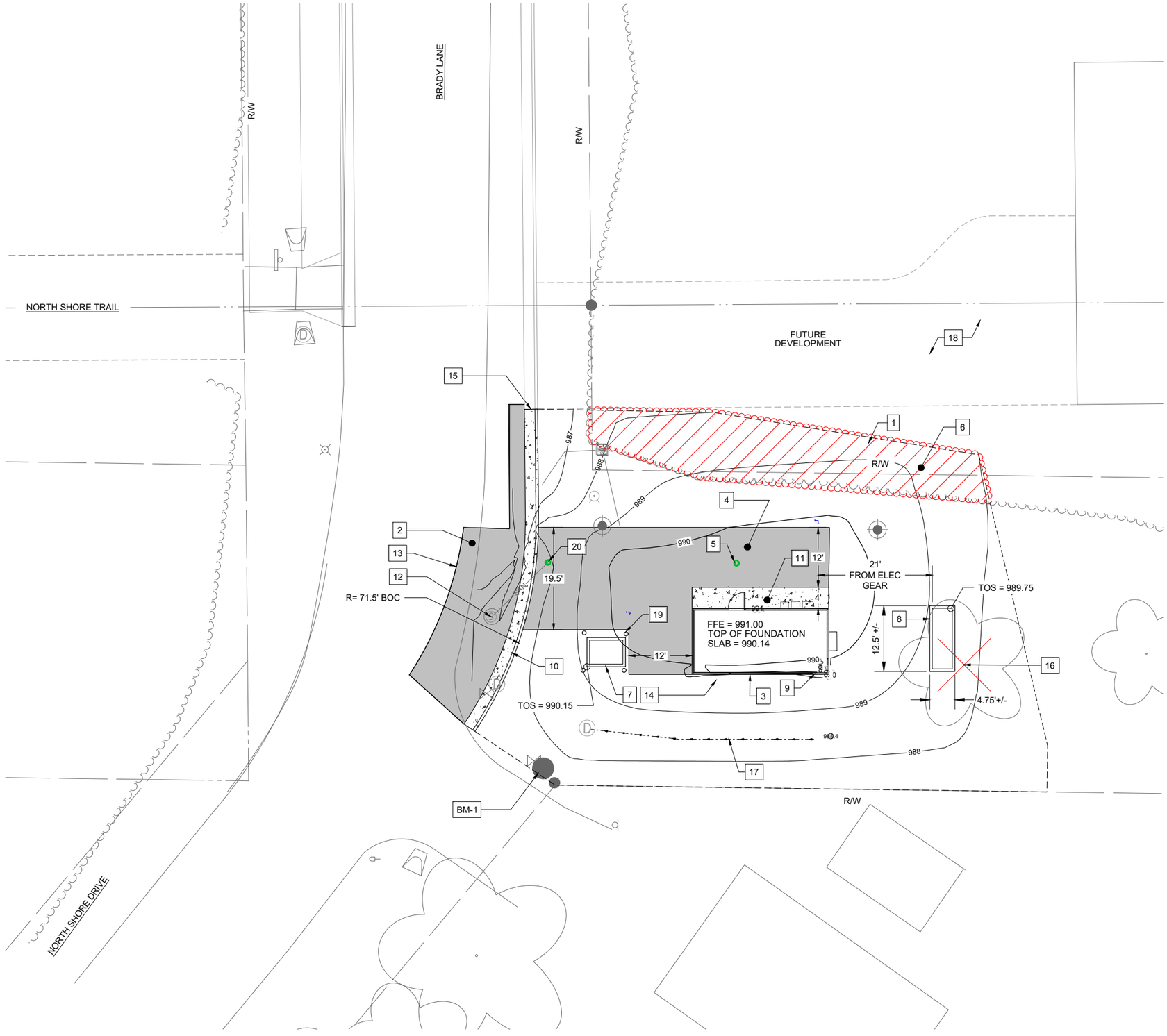
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WATER TOWER #3 AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PRESSURE REDUCING VALVE STATION PROCESS DETAILS

PROJECT NO. 07985049.2
SHEET 20-M501

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0 10 20

GENERAL NOTES

A. ALL ELEVATIONS ARE TO TOP OF FINISHED GRADE UNLESS OTHERWISE SPECIFIED.

B. GRADE SLOPES AWAY FROM THE STATION AT 5% FOR A MINIMUM OF 10 LINEAR FEET FOR PROPOSED PERVIOUS SURFACES (TURF).

C. GRADE SLOPES AWAY FROM BUILDING AT 2% FOR A MINIMUM 10 LINEAR FEET FOR ALL PROPOSED NON-PERVIOUS SURFACES (PAVEMENT).

D. PERMEABLE SURFACES' GRADE AT STATION WALLS SHALL BE A MINIMUM 2 INCHES BELOW TOP OF FOUNDATION SLAB ELEVATION FOR VENEER DRAINAGE.

E. TOP OF GENERATOR SLAB SHALL BE A MIN. OF 6" ABOVE FINISHED GRADE.

KEY NOTES [X]

1. SLOPE INTERCEPT (GRADING LIMITS), TYP.
2. 4" ASPHALTIC CONCRETE PAVEMENT PATCH - SEE TYPICAL SECTIONS
3. PREFABRICATED BOOSTER STATION
4. 4" ASPHALTIC CONCRETE PAVEMENT DRIVEWAY - SEE TYPICAL SECTIONS
5. 4" EXTERIOR SANITARY SEWER CLEANOUT
6. CLEAR & GRUB AS REQ'D FOR STATION CONSTRUCTION
7. PAD MOUNTED ELECTRICAL UTILITY TRANSFORMER, SEE ELECTRICAL SITE PLAN
8. PROVIDE REINFORCED CONCRETE GENERATOR PAD - SEE DETAIL. CONFIRM DIMENSIONS WITH APPROVED GENERATOR SHOP DRAWINGS.
9. UTILITY SUPPLIED NATURAL GAS METER & REGULATOR
10. CONCRETE CURB AND GUTTER, 30-INCH. PROVIDE DRIVE-OVER CUT FULL LENGTH (+3' EACH WAY) FOR DRIVEWAY OPENING.
11. 4' WIDE CONCRETE APRON (6-INCH THICK)
12. ADJUST EXISTING MANHOLE, PROVIDE NEW ADJUSTMENT RINGS, WATERPROOFING, AND CASTING
13. SAWCUT EXISTING PAVEMENT
14. ELECTRICAL SERVICE GEAR, SEE ELECTRICAL PLAN
15. SAWCUT EXISTING CONCRETE CURB & GUTTER. DOWEL INTO EXISTING WITH TWO (2) #5 BARS.
16. GRUB EXISTING TREE AND STUMP
17. GRADE AREA TO DRAIN TO EXISTING STORM SEWER AREA DRAIN
18. FUTURE DRIVEWAY, BY OTHERS
19. PIPE BOLLARDS - TYP. OF FOUR (4) AT TRANSFORMER
20. EXISTING CLEANOUT

BENCHMARK TABLE

TAG	ELEVATION	DESCRIPTION
BM-1	990.2100	TOP NUT OF EXISTING HYDRANT

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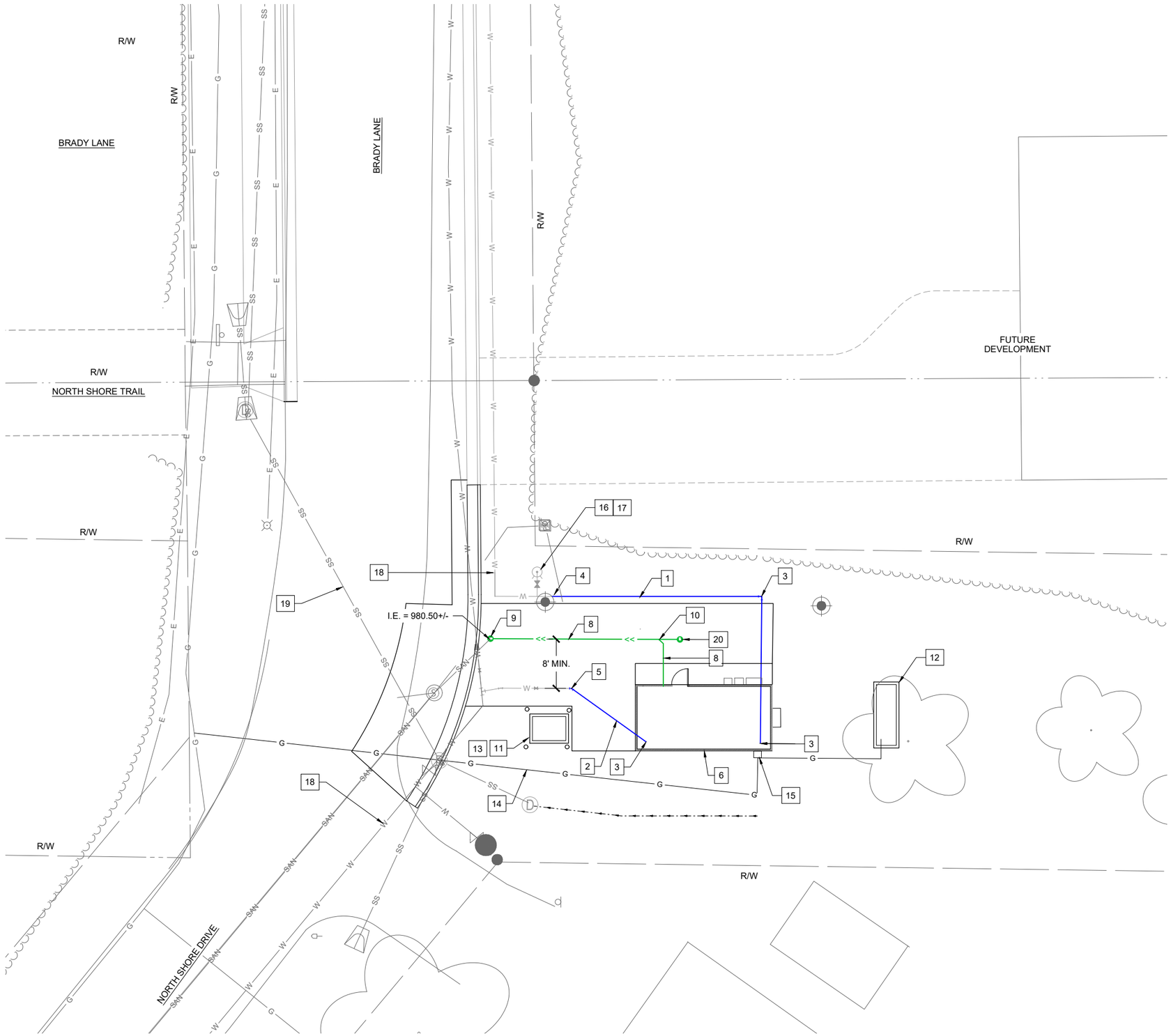
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
SITE AND GRADING PLAN

PROJECT NO. 07985049.2
SHEET 30-C101



GENERAL NOTES

A. REFER TO ENLARGED SITE AND GRADING PLAN FOR DIMENSIONS AND GRADING INFORMATION

B. PROPOSED WATER MAIN SHALL MAINTAIN A MINIMUM BURY DEPTH OF 8' UNLESS OTHERWISE NOTED.

C. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING WATER MAIN BURY DEPTHS AND SIZE.

D. PROVIDE TANDEM MEGALUG JOINT RESTRAINTS AT JOINTS UNDER BUILDING STRUCTURES.

KEY NOTES [X]

1. 8" DUCTILE IRON WATER MAIN (BOOSTED DISCHARGE)
2. 8" DUCTILE IRON WATER MAIN (LOW PRESSURE SUCTION)
3. DUCTILE IRON 90° BEND
4. CONNECT TO EXISTING WATER MAIN. REMOVE PLUG. PROVIDE 8" DUCTILE IRON HARD SLEEVE
5. CONNECT TO EXISTING WATER MAIN. REMOVE PLUG. PROVIDE 8" DUCTILE IRON 45° BEND
6. PREFABRICATED BOOSTER STATION
7. NOT USED
8. 4" PVC SDR 35 SEWER LATERAL
9. CONNECT TO EXISTING SANITARY CLEANOUT
10. 4"x4" PVC WYE
11. PAD MOUNTED ELECTRICAL UTILITY TRANSFORMER, SEE ELECTRICAL SITE PLAN
12. STANDBY GENERATOR, SEE ELECTRICAL SITE PLAN
13. COORDINATE ELECTRICAL SERVICE, SEE ELECTRICAL SITE PLAN
14. COORDINATE NATURAL GAS SERVICE
15. UTILITY SUPPLIED NATURAL GAS METER & REGULATOR
16. EXISTING 6" DUCTILE IRON WATER MAIN (HYDRANT LEAD)
17. EXISTING HYDRANT
18. EXISTING WATER MAIN
19. EXISTING STORM SEWER
20. PROVIDE 4" PVC SANITARY CLEANOUT - REFER TO DETAIL FOR INSTALLATION IN PAVED AREA.

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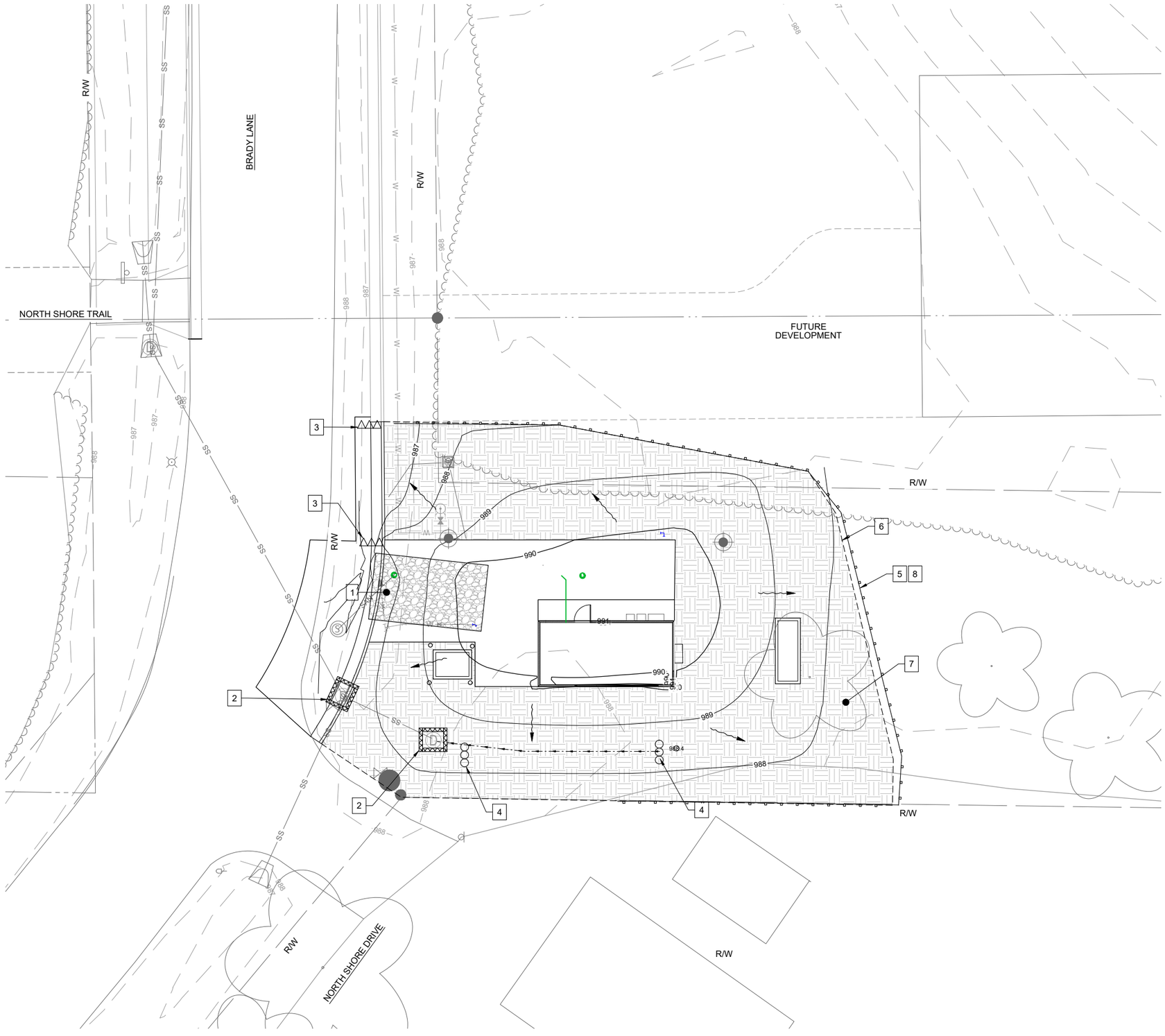
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION UTILITY PLAN

PROJECT NO. 07985049.2
SHEET 30-C102



0 20 40

GENERAL NOTES

A. EROSION CONTROL BMPS SHOWN ARE THE MINIMUM REQUIRED. THE CONTRACTOR SHALL INSTALL ADDITIONAL BMPS TO CONTROL SEDIMENT DISCHARGE AS INDICATED BY THE ENGINEER OR OWNER.

B. SEDIMENT LOGS SHALL BE 12-INCH DIAMETER MINIMUM.

C. EXISTING TOPSOIL SHALL BE STRIPPED, STOCKPILED, AND SALVAGED FOR REUSE ON THE SITE. THE CONTRACTOR SHALL IMPORT ADDITIONAL TOPSOIL AS REQUIRED TO MEET MINIMUM TOPSOIL DEPTHS FOR FINAL RESTORATION.

D. ALL DISTURBED AREAS SHALL BE RESTORED WITH TOPSOIL, SEED, FERTILIZER AND MULCH, UNO.

KEY NOTES [#]

1. TRACKING PAD AT SITE ENTRANCE
2. INLET PROTECTION - TYPE C
3. CHECK DAM AT CURB AND GUTTER (EDGE OF DRIVEWAY ENTRANCE AND MATCH LOCATION)
4. INSTALL SEDIMENT LOGS EVERY 100 LINEAR FEET OR EVERY 2' FEET OF VERTICAL DROP (WHICHEVER IS LESS) PERPENDICULAR TO OVERLAND FLOW IN DITCHLINE.
5. PERIMETER SILT FENCE
6. SLOPE INTERCEPT, TYP.
7. RESTORE DISTURBED AREAS WITH TOPSOIL (SALVAGED OR VIRGIN), SEED, FERTILIZER, AND MULCH (STRAW MULCH, EROSION MAT, OR HYDRO-SEED)
8. SILT FENCE SHALL ALSO FUNCTION AS AN EXCLUSION FENCING - AS REQ'D. PROVIDE FENCING PER WDNR AMPHIBIAN AND REPTILE EXCLUSION FENCING PROTOCOLS.

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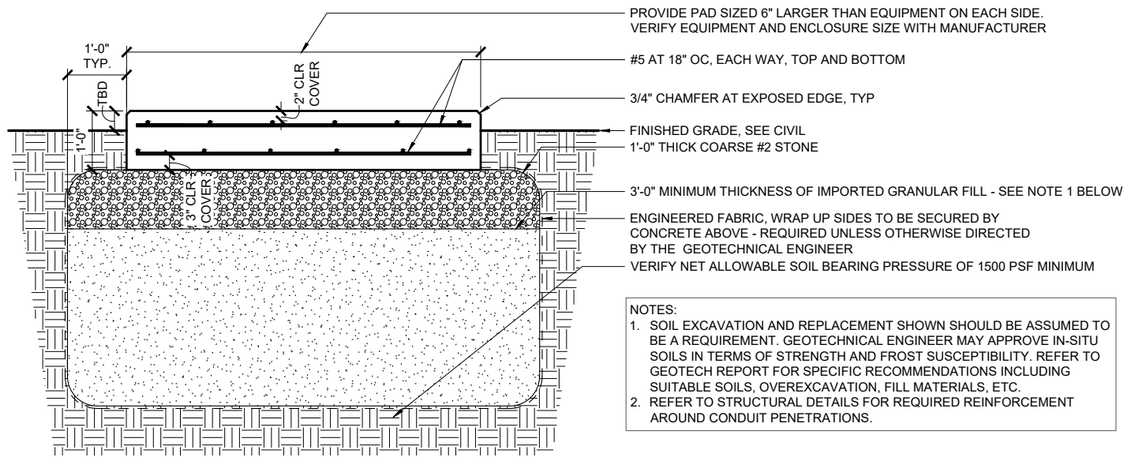
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NORTH BOOSTER STATION
EROSION CONTROL PLAN

PROJECT NO. 07985049.2
SHEET 30-C103



NOTES:
1. SOIL EXCAVATION AND REPLACEMENT SHOWN SHOULD BE ASSUMED TO BE A REQUIREMENT. GEOTECHNICAL ENGINEER MAY APPROVE IN-SITU SOILS IN TERMS OF STRENGTH AND FROST SUSCEPTIBILITY. REFER TO GEOTECH REPORT FOR SPECIFIC RECOMMENDATIONS INCLUDING SUITABLE SOILS, OVEREXCAVATION, FILL MATERIALS, ETC.
2. REFER TO STRUCTURAL DETAILS FOR REQUIRED REINFORCEMENT AROUND CONDUIT PENETRATIONS.

1
30-C501

GENERATOR EQUIPMENT PAD DETAIL

NO SCALE

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	DESIGNED BY: ATR	.	.	.	.
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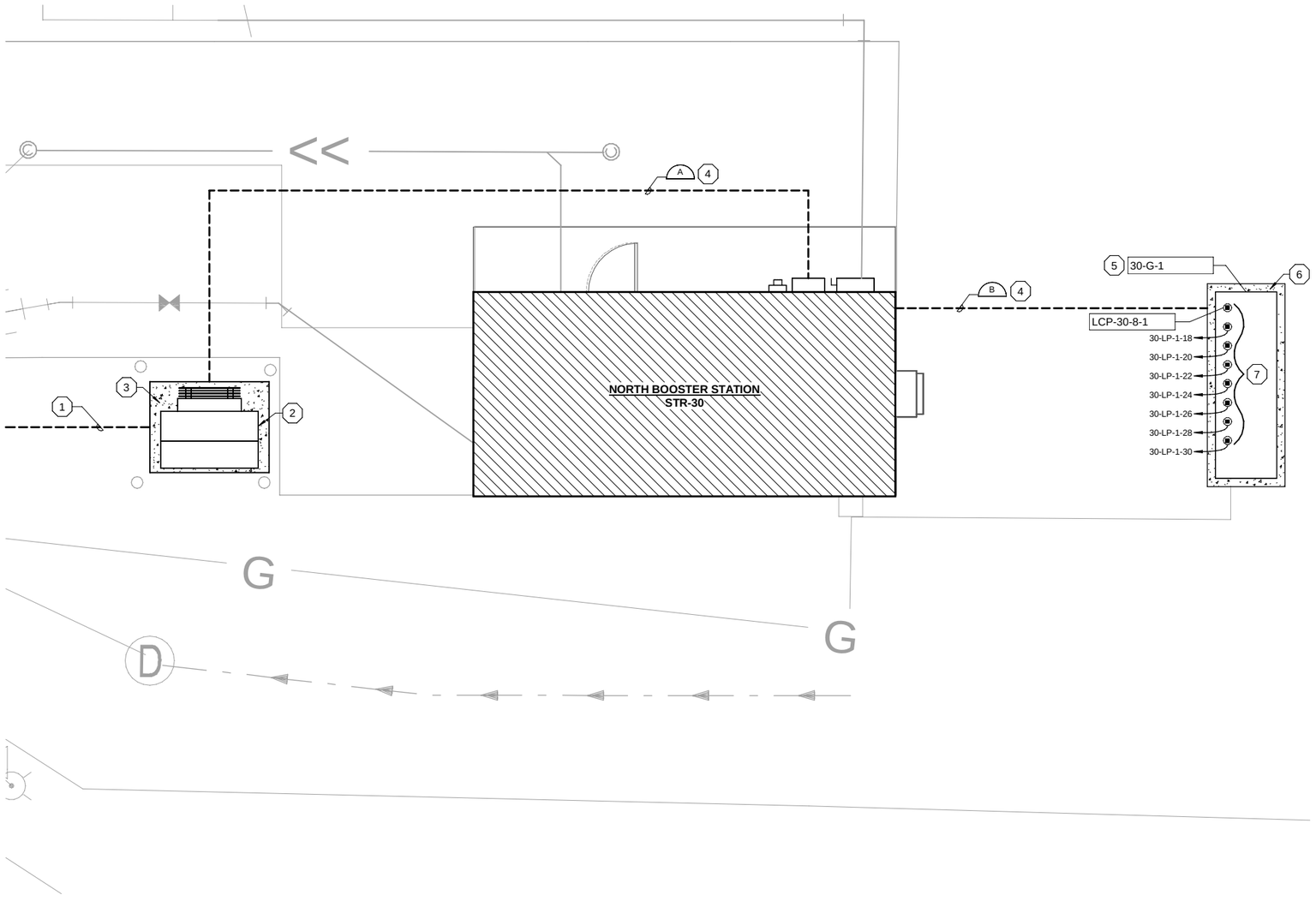
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
GENERATOR EQUIPMENT PAD DETAIL

PROJECT NO. 07985049.2
SHEET 30-C501



SITE PLAN

1/4" = 1'-0" (22" x 34")
1/8" = 1'-0" (11" x 17")
0 2 4 8

GENERAL NOTES

A. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER BEFORE CONTINUING WITH CONSTRUCTION.

B. ALL ELECTRICAL INSTALLATIONS SHALL MEET NEC REQUIREMENTS FOR MINIMUM WORKING SPACE IN FRONT OF EQUIPMENT AND DEDICATED EQUIPMENT SPACE ABOVE SWITCHBOARDS, SWITCHGEAR, PANELBOARDS AND MOTOR CONTROL CENTERS. COORDINATE LAYOUT OF ALL ELECTRICAL EQUIPMENT PRIOR TO INSTALLATION.

C. UNDERGROUND CONDUIT ROUTING IS DIAGRAMMATIC IN NATURE AND IS NOT INTENDED TO DICTATE EXACT ROUTING. CONTRACTOR IS TO DETERMINE BEST ROUTING BASED ON OTHER UTILITIES AND FIELD CONDITIONS.

D. DIRECT BURIED CONDUITS SHALL BE INSTALLED PER DETAIL 2605-310. PROVIDE SPACERS TO PHYSICALLY SEPARATE LOW VOLTAGE AND CONTROL CONDUITS FROM POWER CONDUITS. INSTALL PULL CORD IN ALL EMPTY CONDUITS. UNLESS SHOWN OTHERWISE, ALL CONDUITS SHALL BE BURIED 24" MINIMUM BELOW FINISHED GRADE.

E. PULL BOXES AND HANDHOLES SHALL BE INSTALLED PER DETAIL 2605-550. SIZE PULL BOXES AS REQUIRED FOR DUCT BANK. PROVIDE PULL BOXES AS REQUIRED FOR PULL LENGTH. PULL BOXES AND HANDHOLES INSTALLED WITHIN FIVE FEET OF PAVEMENT AREAS SHALL BE ANSI TIER 22 TRAFFIC RATED WITH EXTRA HEAVY-DUTY COVERS.

F. CONDUIT SHALL BE 3/4" MINIMUM OR AS NOTED OTHERWISE.

G. CONDUIT WALL AND FLOOR PENETRATIONS PER DETAILS 2605-303 AND 2605-305.

H. SEE ONE-LINE DIAGRAMS, PANEL SCHEDULES, AND ELECTRICAL INSTALLATION AND WIRING SCHEDULES FOR WIRING OF ALL FIELD INSTRUMENTATION AND EQUIPMENT.

I. INSTALL FIELD INSTRUMENTATION AND EQIUPMENT PER DETAIL REFERENCED IN ELECTRICAL INSTALLATION AND WIRING SCHEDULES.

J. SEE SCADA SYSTEM NETWORK ARCHITECTURE FOR COMMUNICATIONS CABLING REQUIREMENTS.

K. ROOM/AREA ATMOSPHERE REQUIREMENTS, REFER TO SECTION 26 05 00:
   a. NORTH B.S. SITE EXTERIOR: GENERAL, WET, NEW CONSTRUCTION
   b. NORTH B.S. SITE UNDERGROUND: UNDERGROUND CONSTRUCTION

KEY NOTES (X)

1 APPROXIMATE ROUTE OF NEW UTILITY-PROVIDED ELECTRIC SERVICE PRIMARY CONDUCTORS.
2 PAD MOUNT UTILITY TRANSFORMER. REFER TO ONE-LINE.
3 PROVIDE PAD FOR PAD MOUNT TRANSFORMER. COORDINATE PAD REQUIREMENTS WITH UTILITY.
4 PROVIDE DIRECT BURIED CONDUIT AS SCHEDULED.
5 MAINTAIN GENERATOR SETBACK REQUIREMENTS FROM BUILDING AND ELECTRICAL GEAR AS SHOWN.
6 PROVIDE CONCRETE EQUIPMENT PAD. REFER TO CIVIL DETAILS - INSTALL AS SCHDULED AND PER MANUFACTURERS REQUIREMENTS.
7 COORDINATE EXACT CONDUIT STUB-UP REQUIREMENTS WITH GENERATOR SUBMITTAL DRAWINGS.

UNDERGROUND CONDUIT SCHEDULE

ROUTE	TYPE	CIRCUIT TYPE	NO. OF CONDUITS	SIZE	NOTES
A	DIRECT BURIED	277/480VAC POWER	1	4"	1
B	DIRECT BURIED	277/480VAC POWER	1	4"	
		120/208VAC POWER	1	2"	
		24VDC DISCRETE CONTROL	1	2"	
		MANUFACTURER'S CABLE	1	2"	
		SPARE	1	2"	

GENERAL NOTES
1. REFER TO SECTION 26 05 00 FOR ADDITIONAL REQUIREMENTS.
2. CONDUIT SIZES ARE MINIMUM REQUIRED BASED ON DESIGN CIRCUITS. PROVIDE NUMBER AND SIZE OF CONDUITS AS REQUIRED FOR ACTUAL CIRCUITS

SCHEDULE NOTES
1. COORDINATE WITH UTILITY FOR CONDUIT REQUIREMENTS.

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
ELECTRICAL SITE PLAN

PROJECT NO. 07985049.2
SHEET 30-CE101

GENERAL STRUCTURAL FOUNDATION NOTES

A. SEE GENERAL NOTES ON ARCHITECTURAL DRAWINGS AS THEY APPLY TO THIS WORK.

B. DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ARCHITECT/EOR BEFORE CONTINUING WITH CONSTRUCTION.

C. ALL DIMENSIONS ARE TO FACE OF CONCRETE, UNO.

D. SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL DIMENSIONS.

E. COORDINATE ALL DIMENSIONS SHOWN WITH BUILDING MANUFACTURER. CONFIRM ALL DIMENSIONS WITH BUILDING MANUFACTURER PRIOR TO PLACING FOUNDATION ELEMENTS. ANCHORING OR ATTACHMENT OF THE BUILDING TO THE FOUNDATION SLAB OR WALLS IS BY OTHERS.

F. OPENINGS FOR PROCESS MECHANICAL, PLUMBING, HVAC, AND ELECTRICAL IN WALLS, FLOORS, ROOF, AND OTHER STRUCTURAL ELEMENTS SHALL BE PROVIDED BY BUILDING MANUFACTURER. LOCATION AND SIZE OF THESE OPENINGS SHALL BE THE RESPONSIBILITY OF THE ASSOCIATED CONTRACTOR.

G. CONTRACTOR TO COORDINATE DETAILS, DIMENSIONS, ELEVATIONS, AND OPENINGS BETWEEN STRUCTURAL, ARCHITECTURAL, PLUMBING, HVAC, PROCESS MECHANICAL, AND ELECTRICAL DRAWINGS.

H. SLEEVES, PIPES, AND OTHER ELEMENTS CAST INTO CONCRETE SHALL BE PROVIDED BY THE CONTRACTOR. COORDINATE SIZES AND LOCATIONS WITH CORRESPONDING DISCIPLINE DRAWINGS.

I. NOTIFY ARCHITECT AND EOR OF ANY VARIANCE BEFORE COMMENCING CONSTRUCTION. IN NO CASE SHALL STRUCTURAL ALTERATIONS OR WORK AFFECTING A STRUCTURAL MEMBER BE MADE, UNLESS APPROVED BY EOR.

J. SIMILAR PORTIONS OF THE STRUCTURE SHALL HAVE SIMILAR DETAILING, UNO.

K. FOOTINGS SHALL BE CENTERED UNDER THE WALLS, UNO.

L. FOR BUILDING FOUNDATION WALLS, ALL FORM TIES SHALL BE KNOCKED OFF FLUSH w/ FACE OF THE WALL (INTERIOR AND EXTERIOR.) AT TIES BELOW FINISHED FLOOR AND/OR FINISHED GRADE, INSTALL (1) LAYER OF DAMP-PROOFING PRODUCT OVER THE AREA OF THE REMOVED TIE, TYP.

M. BACKFILL FOUNDATION WALLS ON BOTH SIDES SIMULTANEOUSLY TO AVOID OFFSET LATERAL LOADING CONDITIONS.

N. REFER TO GEOTECHNICAL REPORT FOR REQUIREMENTS AND RECOMMENDATIONS FOR REMOVAL OF UNDESIRABLE SOILS, SITE SOIL, AND SUBGRADE PREPARATIONS. COMPACTION OF SUBGRADE, GRANULAR FILL, AND STRUCTURAL BACKFILL SHALL BE MONITORED BY A QUALIFIED GEOTECHNICAL ENGINEER.

O. SEE ARCHITECTURAL DRAWINGS FOR BOARD INSULATION REQUIREMENTS AT THE BUILDING FOUNDATION PERIMETER AND FOR UNDER-SLAB INSULATION, WHERE REQUIRED.

P. CONTRACTOR SHALL REFER TO GEOTECHNICAL REPORT FOR EXISTING SOIL INFORMATION, EXPECTED GROUNDWATER CONTROLS, AND BACKFILL RECOMMENDATIONS.

Q. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND REMOVAL OF ALL TEMPORARY BRACING AND CONSTRUCTION SUPPORTS FOR STRUCTURES AS NECESSARY TO COMPLETE THE PROJECT. NO PORTION OF THE PROJECT, WHILE UNDER CONSTRUCTION IS INTENDED TO BE STABLE IN THE ABSENCE OF THE CONTRACTOR'S TEMPORARY BRACES AND SUPPORTS. CONTRACTOR SHALL RETAIN A STRUCTURAL ENGINEER LICENSED IN THE STATE OF PROJECT LOCATION TO DESIGN ALL TEMPORARY BRACING AND CONSTRUCTION SUPPORT.

CONCRETE AND REINFORCING NOTES

1. ALL LAPS SHALL BE CLASS 'B' PER ACI 318, CURRENT EDITION, UNO ON THE DESIGN DRAWINGS.

2. LAP LENGTH SHALL BE SPECIFICALLY NOTED BY DETAILER ON SHOP DRAWINGS WHEN MORE THAN ONE BAR MAKES UP A CONTINUOUS STRING. DETAILER SHALL PROVIDE STAGGERED LAPS FOR CONTINUOUS BAR RUNS. TOP BAR LAP LENGTHS SHALL BE USED FOR ALL HORIZONTAL WALL BARS AND FOR BARS IN SLABS WITH MORE THAN 12" OF CONCRETE BELOW THE LAP.

3. BAR PLACEMENT TOLERANCES SHALL BE AS SPECIFIED IN THE CONCRETE REINFORCING STEEL INSTITUTE (CRSI) MANUAL OF STANDARD PRACTICE, CURRENT EDITION.

4. ALL REINFORCING BAR LENGTHS ARE FROM OUT-TO-OUT OF BAR. ALL BEND ANGLES ARE AT 45° AND 90° UNO. BAR SPACINGS ARE ON-CENTER UNO.

5. PROVIDE ADDITIONAL DIAGONAL REINFORCING AROUND ALL OPENINGS AND PENETRATIONS THROUGH WALLS AND SLABS. - SEE DETAIL 1/30-S501.

6. DOWEL BAR HOOKS SHALL BE PLACED AT THE SAME HORIZONTAL LEVEL AS BOTTOM LAYER STEEL REINFORCING, UNO.

DESIGN LOADS AND CRITERIA

BUILDING CODE....WISCONSIN COMMERCIAL BUILDING CODE, REFERS TO IBC 2021
BUILDING RISK CATEGORY....IV

WIND LOADS*

BASIC WIND SPEED....121 MPH
WIND EXPOSURE....C
PER ASCE 7-16, SIMPLIFIED DESIGN PROCEDURE
MAIN WIND FORCE RESISTING SYSTEM
WALLS (LATERAL) ZONE A.... +35.3 PSF
ZONE C.... +23.5 PSF
ROOF (LATERAL) ZONE B/D.... -11.7 PSF
ROOF (UPLIFT) ZONE E.... -33.7 PSF
ZONE F.... -22.0 PSF
OVERHANG MAX.... -47.3 PSF
COMPONENTS AND CLADDING (C&C)
ASSUMED EFFECTIVE WIND AREA....10 SF
ROOF C&C, VERTICAL PRESSURES:
TYPICAL POS. PRESSURE.... +19.3 PSF
INT ZONE 1 NEG. PRESSURE.... -59.0 PSF
EDGE ZONE 2 NEG. PRESSURE.... -85.9 PSF
CORNER ZONE 3 NEG. PRESSURE.... -102.2 PSF
WALL C&C HORIZONTAL PRESSURES:
POS. PRESSURE.... +31.9 PSF
NEG. PRESSURE.... -42.7 PSF
OVERHANG TYP.... -129.5 PSF

* PLUS AND MINUS SIGNS SIGNIFY PRESSURES ACTING TOWARD AND AWAY FROM THE SURFACES, RESPECTIVELY.

SEISMIC DESIGN DATA

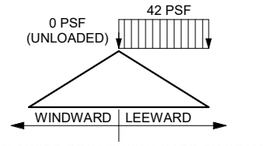
SEISMIC IMPORTANCE FACTOR, Ie....1.5
SEISMIC DESIGN CATEGORY....A
SEISMIC SITE CLASS....D [PRESUMED]
ANALYSIS PROCEDURE....EQUIVALENT LATERAL FORCE
MAPPED SPECTRAL RESPONSE ACCELERATIONS
Ss....0.045
S1....0.029
SPECTRAL RESPONSE COEFFICIENTS
Sds....0.048
Sd1....0.046
SEISMIC FORCE-RESISTING SYSTEM....LIGHT-FRAME WALLS WITH SHEAR PANELS OF ALL OTHER MATERIALS
SEISMIC RESPONSE COEFFICIENT, Cs....0.01
RESPONSE MODIFICATION FACTOR, R....2.0
SEISMIC BASE SHEAR, V....0.5 KIPS

LIVE LOADS

ROOF LIVE LOAD (MINIMUM)....20 PSF
FLOOR LIVE LOAD....125 PSF

SNOW LOADS

GROUND SNOW LOAD, Pg.... 50.0 PSF
FLAT-ROOF SNOW LOAD, Pf.... 42.0 PSF
SNOW EXPOSURE FACTOR, Ce....1.00
SNOW IMPORTANCE FACTOR, Is....1.20
THERMAL FACTOR, Ct....1.00
SLOPED ROOF SNOW LOAD, Ps....42.0 PSF
ROOF SLOPE FACTOR, Cs....1.00
DESIGN SNOW LOAD....42.0 PSF
UNBALANCED ROOF SNOW LOADS....NOT REQD FOR ROOF SLOPES < 15 DEG]



NOTE:
LOADS CAN OCCUR ON EITHER SIDE OF RIDGE

UNBALANCED ROOF SNOW LOADS DIAGRAM

DESIGN STRESSES

GEOTECHNICAL INFORMATION

NET ALLOWABLE SOIL BEARING PRESSURE....q = 3,000 PSF
MIN REQD SOIL BEARING PRESSURE....qmin = 2,000 PSF
GEOTECHNICAL REPORT No. 23366.24.WIL PREPARED BY:
CHOSEN VALLEY TESTING, INC.
DATED: APRIL 26, 2024

CAST-IN-PLACE CONCRETE

FOOTINGS.... f'c = 4000 PSI
WALLS.... f'c = 4000 PSI
SLAB-ON-GRADE.... f'c = 4000 PSI
OTHER.... f'c = 3500 PSI

REINFORCING STEEL

REINFORCING.... fy = 60 KSI

STEEL REINFORCING

MIN CLEAR COVER, UNO

FOUNDATION WALLS
#5 BARS & SMALLER.... 1 1/2"
#6 BARS & LARGER....2"

NON-STRUCTURAL SLABS-ON-GRADE
BOTTOM & SIDES.... 1 1/2"
TOP.... 3/4"

FOOTINGS AND STRUCTURAL SLABS-ON-GRADE
BOTTOM & SIDES.... 3"
TOP.... 2"

GENERAL NOTES

1. CLASS 'B' LAP SPLICES: #5 BARS = 31"; #6 BARS = 37"
2. STANDARD HOOKS: #5 = 10"; #6 = 12"

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PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJK	No	DATE	REVISIONS	BY
	DESIGNED BY: SHG				
	CHECKED BY: KEB				

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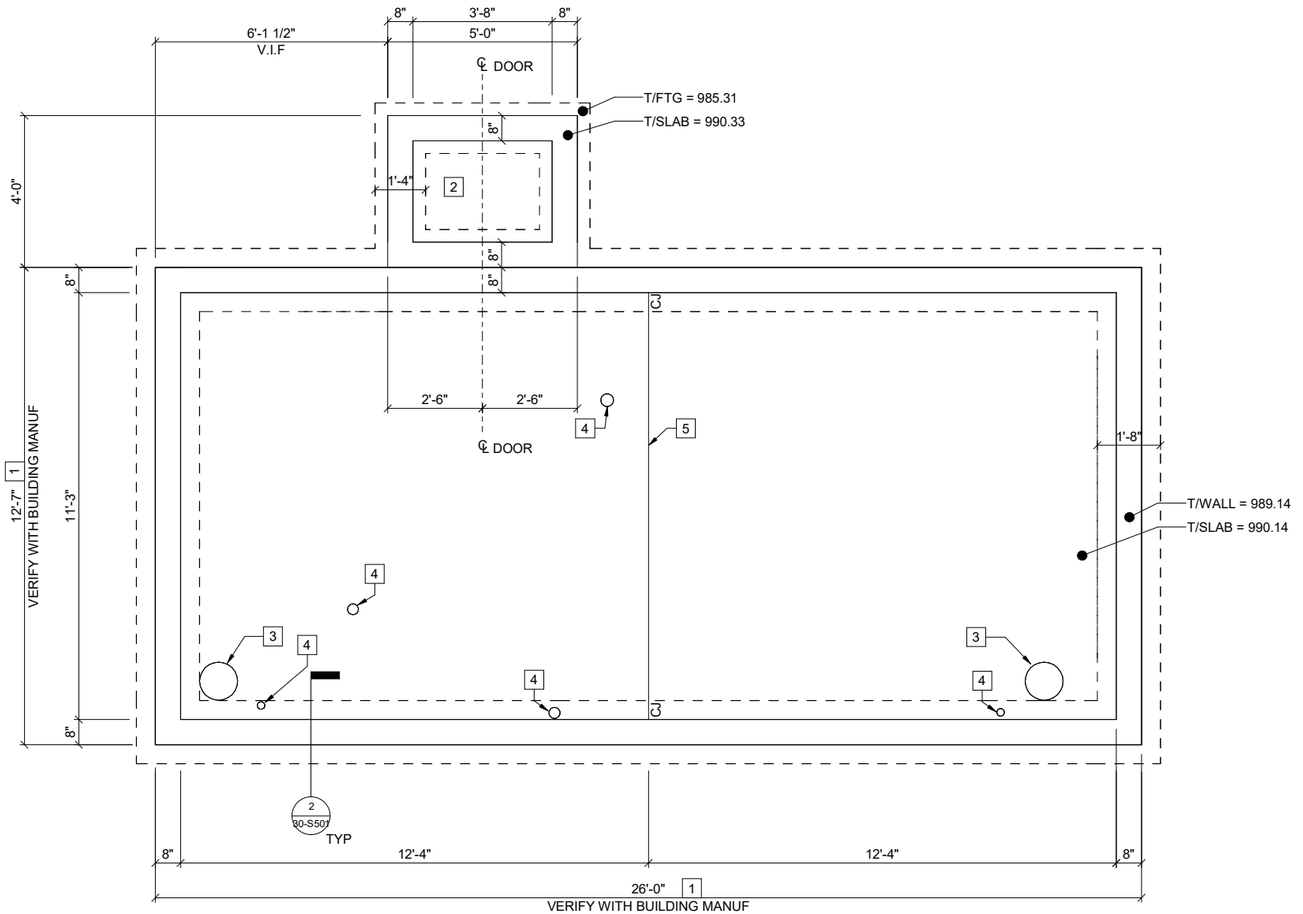
NORTH BOOSTER STATION
STRUCTURAL SCHEDULES AND GENERAL NOTES

PROJECT NO. 07985049.2
SHEET 30-S001

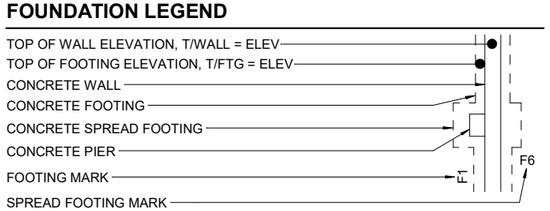
KEY NOTES [#]

1. 12" THICK FLAT AND LEVEL CONCRETE SLAB ON FOUNDATION WALL w/ #5 BARS AT 12" OC EACH WAY TOP AND BOTTOM OVER VAPOR BARRIER OVER 12" THICK COMPACTED GRAVEL FILL. SLAB SHALL HAVE A FLOOR FLATNESS (FF) OF 50 (SINGLE 1/8" DEFECT ACROSS 10') AND HAVE A FLOOR LEVELNESS (FL) OF 35 (VERY FLAT). VERIFY DIMENSIONS WITH BUILDING MANUF.
2. COORDINATE STOOP SIZE AND LOCATION WITH BUILDING MANUF
3. PROCESS MECHANICAL PIPE THROUGH FLOOR SLAB LOCATION - SEE PROCESS MECHANICAL. COORDINATE FINAL LOCATION w/ BUILDING MANUF. PROVIDE THROUGH SLAB. OPENING REINFORCING PER DETAIL 1/30-S501
4. SANITARY PIPE THROUGH FLOOR SLAB LOCATION - SEE PROCESS MECHANICAL. COORDINATE FINAL LOCATION w/ BUILDING MANUFACTURER. PROVIDE SLEEVE THROUGH SLAB FOR PLUMBING PIPE
5. CONTROL JOINT (CJ) - SEE DETAIL 4/30-S501

NOTE: COORDINATE ALL DIMENSIONS SHOWN WITH BUILDING MANUFACTURER. DOOR LOCATIONS AND BUILDING SIZE ARE SUBJECT TO CHANGE. CONFIRM ALL DIMENSIONS WITH BUILDING MANUFACTURER PRIOR TO PLACING FOUNDATION ELEMENTS. CONTRACTOR TO ADJUST SIZES WITH NO CHANGE IN COST TO THE OWNER.



FOUNDATION LEGEND



FOUNDATION PLAN

1/2" = 1'-0" (22" x 34")
1/4" = 1'-0" (11" x 17")
0 1 2 4

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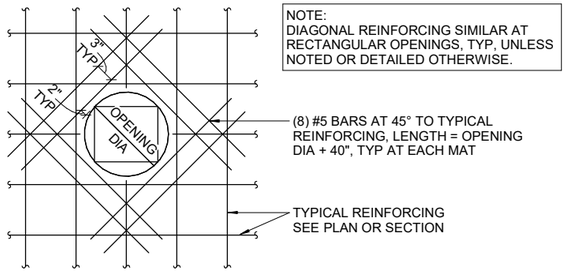
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
NEW RICHMOND, ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION FOUNDATION PLAN

PROJECT NO. 07985049.2
SHEET 30-S101

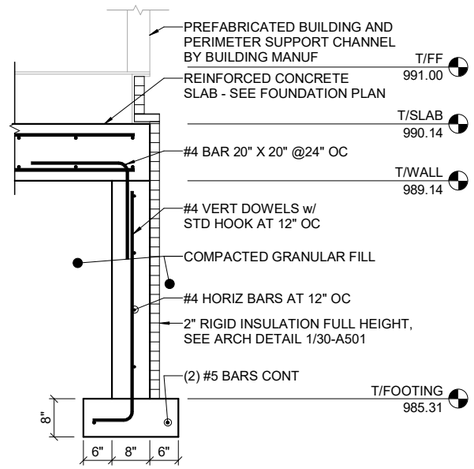
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NOTE:
DIAGONAL REINFORCING SIMILAR AT RECTANGULAR OPENINGS, TYP, UNLESS NOTED OR DETAILED OTHERWISE.

1 DIAGONAL REINF AT CONCRETE WALL AND SLAB OPENINGS

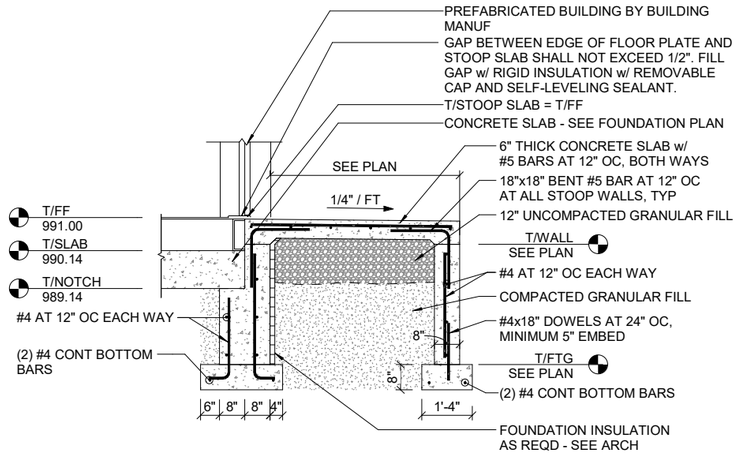
30-S501 1/4" = 1'-0" (22" x 34") 0 2 4 8
1/8" = 1'-0" (11" x 17")



NOTE: PROVIDE 18" x 18" CORNER HORIZ BARS AT INTERSECTING WALLS. BARS SHALL BE THE SAME SIZE AND LOCATIONS AS TYP HORIZ REINF BARS.

2 TYPICAL FOUNDATION WALL DETAIL

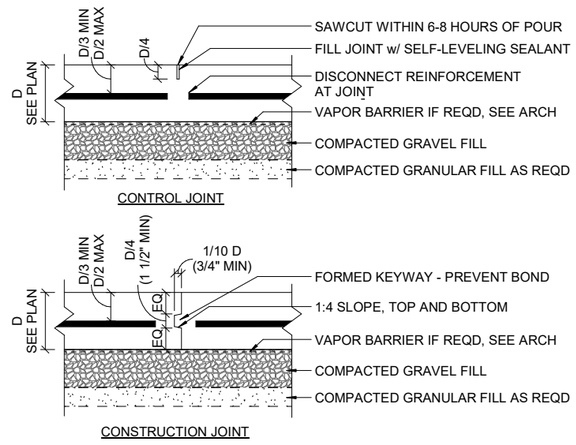
30-S501 3/4" = 1'-0" (22" x 34") 0 6" 1' 2' 3'
3/8" = 1'-0" (11" x 17")



NOTES:
1. STOOP IS A STRUCTURAL SLAB; THEREFORE, REINFORCEMENT AND SLAB THICKNESS ARE CRITICAL
2. PROVIDE 18"x18" BENT #5 BAR AT 12" OC WHERE STOOP SLAB MEETS BUILDING WALL. ALTERNATIVELY PROVIDE BENT #5 BAR WITH (1) 18" HORIZONTAL LEG, DRILL AND EPOXY WITH MINIMUM 6" EMBED.

3 STOOP DETAIL

30-S501 1/2" = 1'-0" (22" x 34") 0 1 2 4
1/4" = 1'-0" (11" x 17")



4 TYPICAL SLAB-ON-GRADE CJ DETAIL

30-S501 1 1/2" = 1'-0" (22" x 34") 0 6" 1' 2' 3'
3/4" = 1'-0" (11" x 17")

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
NEW RICHMOND, ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION STRUCTURAL DETAILS

PROJECT NO. 07985049.2
SHEET 30-S501

GENERAL NOTES

A. ALL DIMENSIONING IS TO FACE OF STUD, FRAMING, CMU, OR CONCRETE.
B. DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER BEFORE CONTINUING WITH CONSTRUCTION.
C. OPENINGS FOR VENTILATION, PLUMBING, PROCESS MECHANICAL, AND ELECTRICAL WORK IN WALLS, FLOORS, ROOF, CEILING, ETC, SHALL BE PROVIDED BY THE GC. LOCATION AND SIZE OF THESE OPENINGS SHALL BE THE RESPONSIBILITY OF THE ASSOCIATED CONTRACTOR.
D. EXTERIOR WALL AND RELATED EXTERIOR OPENINGS BY ALL TRADE PENETRATIONS SHALL BE FLASHED AND CAULKED BY THE GC.
E. ALL EXPOSED ANCHORS, PIPING, CONDUIT, DUCTWORK, AND INSULATION WITHOUT FINISHED JACKET SHALL BE PAINTED, UNO.

KEY NOTES [#]

1. FIRE ESTINGUISHER AND BRACKET
2. NEC ELECTRICAL WORKING SPACE - SEE ELECTRICAL
3. CONCRETE STOOP - SEE STRUCTURAL
4. PROCESS MECHANICAL EQUIPMENT AND PIPING - SEE MECHANICAL SHEETS
5. BUILDING SIZE BY BUILDING MANUFACTURER
6. INSULATED WALL PANEL BY BUILDING MANUFACTURER
7. HVAC SYSTEM
8. HIGH EFFICIENCY DEHUMIDIFIER - FLOOR MOUNTED BY BUILDING MANUFACTURER
9. LOUVER BLOWER BY BUILDING MANUFACTURER
10. ELECTRICAL SERVICE GEAR
11. CHEMICAL CLOSET FOR FUTURE CHEMICAL FEED EQUIPMENT
12. CONCRETE PAVEMENT OVER COMPACTED GRANULAR FILL - REFER TO SITE PLAN.
13. CONTRACTION JOINT, TYP.
14. 1/2" EXPANSION JOINT WITH FLOWABLE SEALANT
15. 10 MIL REINFORCED VAPOR BARRIER UNDER 12-INCH THICK CONCRETE SLAB
16. 2" RIGID INSULATION ALONG FOUNDATION WALL (FULL HEIGHT) AROUND PERIMETER OF FOUNDATION WALLS
17. ELECTRICAL SERVICE EQUIPMENT

DOOR SCHEDULE

OPENING No	DOOR					FRAME		REMARKS
	TYPE	MAT'L	NOMINAL SIZE			TYPE	MAT'L	
			WIDTH	HEIGHT	THICKNESS			
102E	FLUSH	STEEL	3' - 0"	6' - 8"	2"	DOUBLE RABBET	STEEL	1,2,3,4
102G	FLUSH	STEEL	3' - 0"	6' - 8"	2"	DOUBLE RABBET	STEEL	1,5

GENERAL NOTES

A. REFER TO SECTION 13 34 30.

REMARKS

1. UNDERCUT DOOR 3/4 INCH
2. LOCKSET SHALL BE CYLINDRICAL WITH SATIN STAINLESS STEEL FINISH.
3. PROVIDE METAL SHIELD ABOVE DOOR FOR RAIN & SNOW DIVERSION.
4. PROVIDE EXTRUDED ALUMINUM SILL PLATE.
5. INSTALL WARNING SIGN TO EXTERIOR OF DOOR AFTER PAINTING IS COMPLETE

ROOM FINISH SCHEDULE

ROOM No	ROOM NAME	FLOOR	BASE	WALLS				CEILING		REMARKS
				NORTH	EAST	SOUTH	WEST	MAT'L	HEIGHT	
101	PUMP ROOM	F1	-	W1	W1	W1	W1	C1	8'-0"	
102	CHEMICAL	F1	-	W2	-	-	W2	C1	8'-0"	

GENERAL NOTES

A. PAINT ALL EXPOSED PIPES, CONDUIT, DUCTWORK, ETC.
B. VINYL BASE AT DRYWALL WALLS ONLY

REMARKS

1. NONE

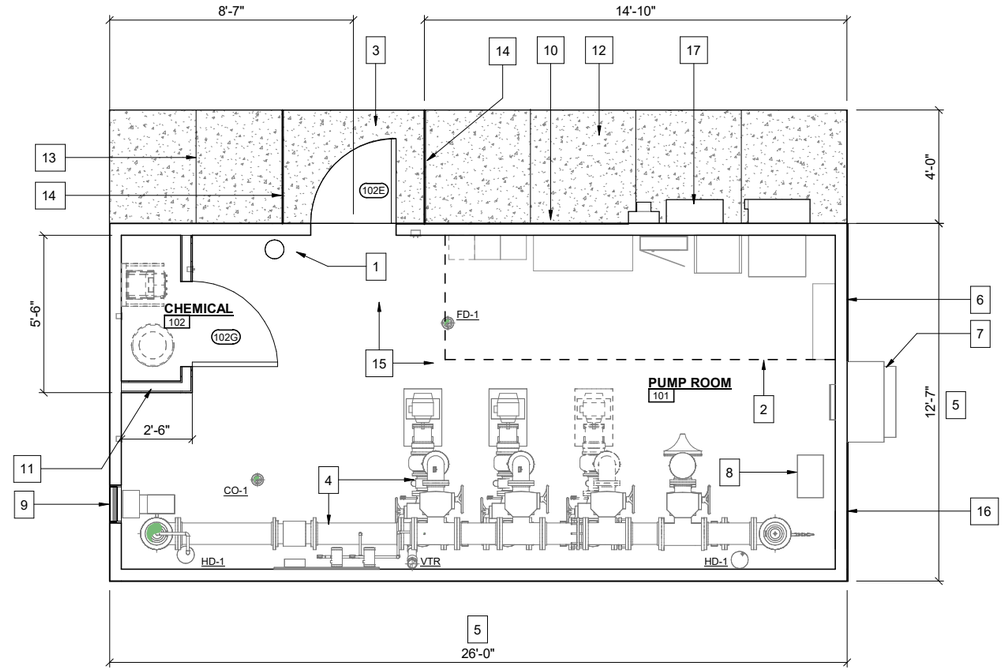
LEGEND

FLOOR:
F1. NEOPRENE FLOOR MAT OVER 10" CHANNEL OVER 12" THICK REINFORCED SLAB W/ 10 MIL VAPOR BARRIER

BASE:
- NONE

WALLS:
- NONE
W1: INSULATED WALL PANEL (BY MANUFACTURER)
W2: INTERIOR WALL PANEL (BY MANUFACTURER)

CEILINGS:
C1: INSULATED CEILING PANEL (BY MANUFACTURER)



FLOOR PLAN

3/8" = 1'-0" (22"x34")
3/16" = 1'-0" (11"x17")
0 1 2 4 6

No	DATE	REVISIONS	BY

PROJECT DATE: NOVEMBER 18, 2025
DRAWN BY: JJY
DESIGNED BY: ATR
CHECKED BY: EE

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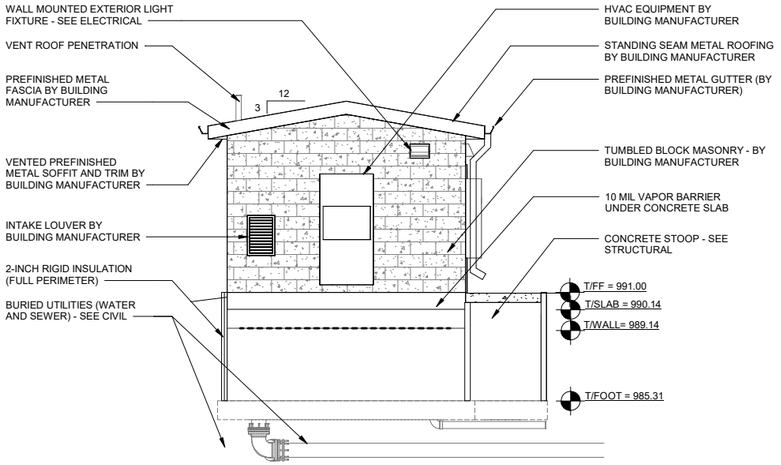
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
NEW RICHMOND, ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
FLOOR PLAN

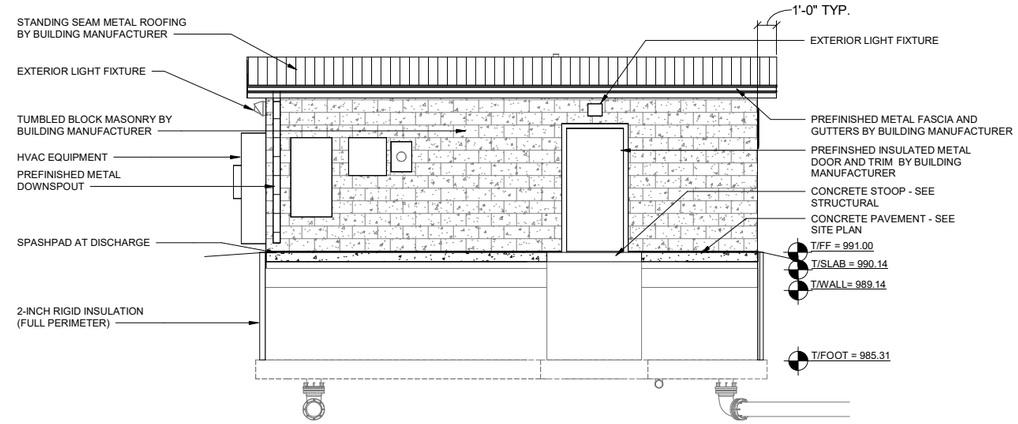
PROJECT NO. 07985049.2
SHEET 30-A101

PLOT DATE: 11/17/2025 12:39:37 PM
Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_Prefabricated Building.rvt



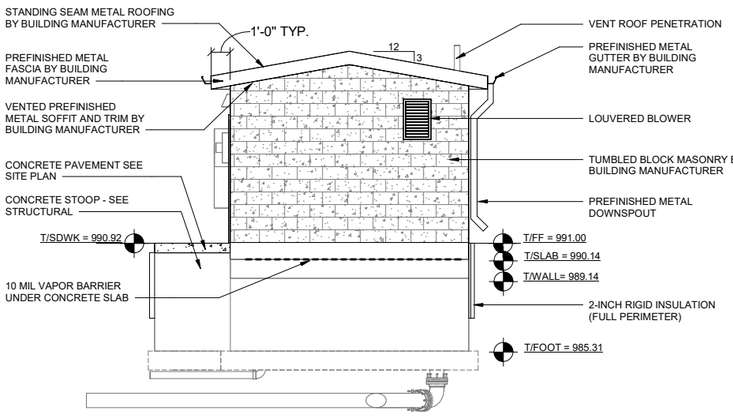
EAST EXTERIOR BUILDING ELEVATION

1/4" = 1'-0" (22"x34")
1/8" = 1'-0" (11"x17")



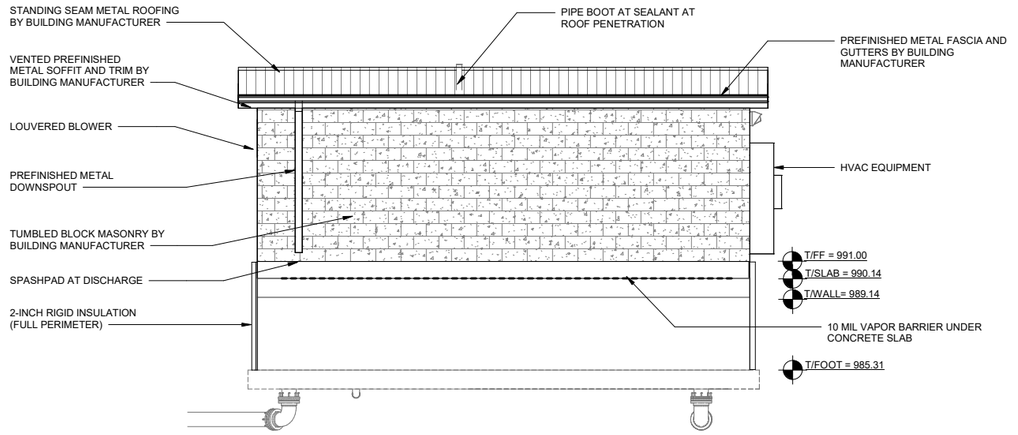
NORTH EXTERIOR BUILDING ELEVATION

1/4" = 1'-0" (22"x34")
1/8" = 1'-0" (11"x17")



WEST EXTERIOR BUILDING ELEVATION

1/4" = 1'-0" (22"x34")
1/8" = 1'-0" (11"x17")



SOUTH EXTERIOR BUILDING ELEVATION

1/4" = 1'-0" (22"x34")
1/8" = 1'-0" (11"x17")

PLOT DATE: 11/17/2025 12:39:38 - Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_Prefabricated Building.rvt

PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY
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	CHECKED BY: BJS

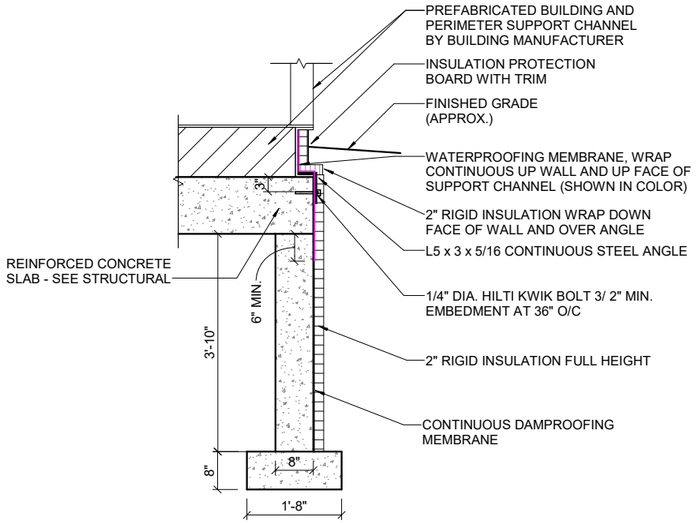
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
NEW RICHMOND, ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION EXTERIOR ELEVATIONS

PROJECT NO. 07985049.2
SHEET 30-A201



1 30-A501 **BASE OF BUILDING ANCHOR DETAIL**

3/4" = 1'-0" (22"x34")
1-1/2" = 1'-0" (11"x17")

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PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
NEW RICHMOND, ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
ARCHITECTURAL DETAILS

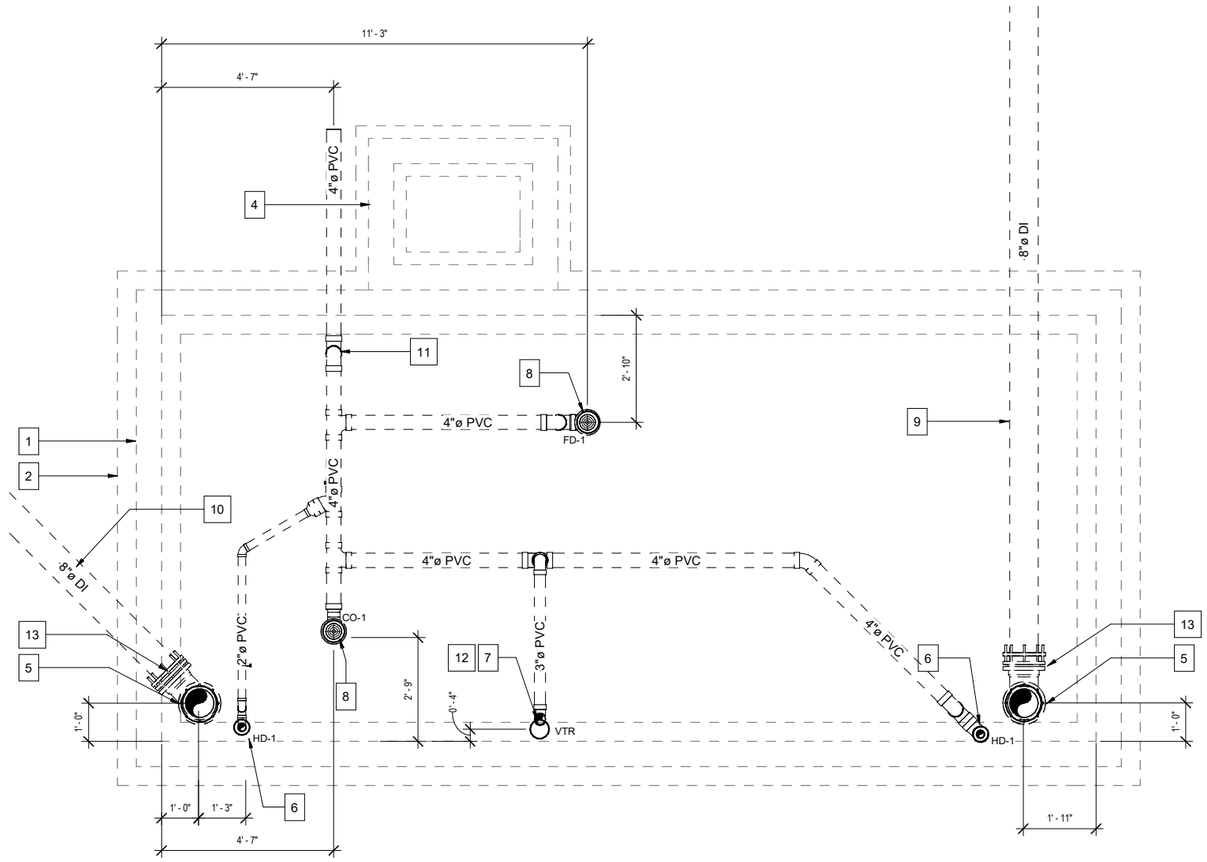
PROJECT NO. 07985049.2
SHEET 30-A501

KEYNOTES:

1. TOP OF CAST-IN-PLACE CONCRETE FOUNDATION WALL, SEE STRUCTURAL
2. EDGE OF CAST-IN-PLACE CONCRETE FOUNDATION FOOTING, SEE STRUCTURAL
3. NOT USED
4. EDGE OF CAST-IN-PLACE CONCRETE STOOP, SEE STRUCTURAL
5. PENETRATION SHALL BE A MIN. OF 11" IN DIAMETER FOR WATERMAIN VERTICAL PIPING THROUGH SLAB AND FLOOR
6. PENETRATION SHALL BE A MIN. OF 5" IN DIAMETER FOR HUB DRAIN VERTICAL RISERS THROUGH SLAB AND FLOOR
7. PENETRATION SHALL BE A MIN. OF 6" IN DIAMETER FOR DRAIN VENT VERTICAL PIPING THROUGH SLAB AND FLOOR
8. PENETRATION SHALL BE A MIN. OF 7" IN DIAMETER FOR FLOOR DRAIN AND CLEANOUT FIXTURES. PROVIDE VERTICAL RISERS THROUGH SLAB AND FLOOR. CONTRACTOR SHALL FURISH A RECESSED DRAIN FITTING TO INSTALL ON RISER. CONTRACTOR SHALL BACKFILL ANNULAR SPACE BETWEEN FLOOR JOISTS AND SLAB PENETRATION WITH NON SHRINK GROUT.
9. 8" DUCTILE IRON (MECHANICAL JOINT) - BOOSTER DISCHARGE
10. 8" DUCTILE IRON (MECHANCAL JOINT) - LOW PRESSURE SUCTION
11. PROVIDE REQUIRED PVC BENDS TO DROP PIPE TO A MIN. ELEVATION OF 6" BELOW BOTTOM OF FOOTING. PENETRATION THROUGH STOOP OR FOUNDATION WALL WILL NOT BE PERMITTING FOR SANITARY OR WATER PIPING NETWORKS
12. ROUTE VENT STACK VERTICALLY THROUGH SLAB & FLOOR. SECURE TO WALL
13. DUCTILE IRON 90 DEGREE BEND. PROVIDE TANDEM MEGA-LUG JOINT RESTRAINTS AND CONCRETE THRUST RESTRAINT BLOCKING. REFER TO CIVIL DETAILS FOR WATERMAIN THRUST BLOCK REQUIREMENTS.

GENERAL NOTES:

A. FLANGED CONNECTION SHOWN ON DRAWINGS, PACKAGED BOOSTER SKID SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER OR OWNER.
B. BELOW GRADE DUCTILE IRON PIPE SHALL BE MECHANICAL JOINTED, CLASS 53 DUCTILE IRON. VERTICAL PIPES SHALL BE FIELD CUT TO LENGTH FOR CONNECTION WITH THE PREFABRICATED BOOSTER STATION PIPING. THE CONTRACTOR SHALL PROVIDE RESTRAINED FLANGE ADAPTER TO CONNECT TO THE PREFABRICATED PIPING. ANNULAR SPACE BETWEEN THE SLAB AND THE VERTICAL PIPE, AND THE JOISTS AND THE VERTICAL PIPE SHALL BE FILLED WITH NONE SHRINK GROUT.
C. ALL DRAIN PIPING SHALL BE CONSTRUCTED FROM SCH. 40 PVC.
D. DASHED LINEWORK INDICATES BELOW GRADE PIPING AND/OR EQUIPMENT



BELOW GRADE PROCESS PLAN

1/2" = 1'-0" (22"x24")
1/4" = 1'-0" (11"x17")
0 1 2 4

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WATER TOWER NO. 3 AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
PROCESS BELOW GRADE PLAN

PROJECT NO. 07985049.2
SHEET 30-M101

PLOT DATE: 11/17/2025 12:51:54 PM
Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_MECH.rvt

KEYNOTES:

1. PREFABRICATED BOOSTER STATION
2. HVAC UNIT BY BUILDING MANUFACTURER
3. FLOOR MOUNTED HIGH EFFECIENCY DEHUMIDIFIER BY STATION MANUFACTURER.
4. LOUVED BLOWER BY STATION MANUFACTURER
5. FUTURE SODIUM HYPOCHLORITE PUMP AND PUMP SHELF
6. FUTURE CHEMICAL STORAGE TANK AND SECONDARY CONTAINMENT
7. HUB DRAIN FOR PROCESS PIPING DISCHARGE. SEE DETAIL.
8. COPPER DISCHARGE PIPING FOR AIR RELEASE VALVE. PLUMB TO HUB DRAIN SEE DETAIL.
9. FLOOR DRAIN, INSTALL FLUSH WITH FINISHED FLOOR. REFER TO 30-M101
10. INTERIOR CLEANOUT, INSTALL FLUSH WITH FINISHED FLOOR - REFER TO 30-M101
11. DRAIN VENT TO ROOF - SECURE TO VERTICAL WALL. PROVIDE ROOFING BOOT AND SEALANT AT ROOF PENETRATION.
12. INSTRUMENT PANEL - SEE DETAIL. MOUNTED ALUMINUM RACK TO STATION WALL. PROVIDE ENGRAVED LABELS.
13. 8-INCH RESTRAINED EXPANSION JOINT FITTING
14. SMOOTH BORE SAMPLE TAP (1/2"). PROVIDE TAP AND BALL VALVE FOR ISOLATION.
15. PROVIDE BENDS AS NEEDED TO CLEAR PROCESS PIPING
16. FLOW TRANSMITTER - MOUNTED TO INSTRUMENT PANEL
17. 3/4" NPT TAP WITH BALL VALVE AND PRESSURE GAUGE FOR BOOSTER PUMP DISCHARGE - TYP. OF ALL PROPOSED PUMPS

GENERAL NOTES:

A. BOOSTER STATION PROCESS PIPING 3"+ IS SHOWN AS FLANGED CLASS 53 DUCTILE IRON. REFER TO SPECIFICATOINS FOR ALTERNATE PIPING MATERIAL.
B. FLANGED CONNECTION ARE SHOWN ON DRAWINGS, PACKAGED BOOSTER SKID SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER AND OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE.
D. FUTURE EQUIPMENT AND PIPING SHOWN AS DASHED LINEWORK IN VIEW.
E. PROVIDE ALL PIPE WITH STICKER OR PAINTED LABELS WITH FLOW DIRECTION ARROWS. REFER TO DIVISIN 40.
F. SUCTION SIDE PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4063 ROBOTIC BLUE, OR EQUAL. DISCHARGE (BOOSTED) PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4086 SAFETY BLUE, OR EQUAL.

PUMP/INSTRUMENT SCHEDULE - PROPOSED

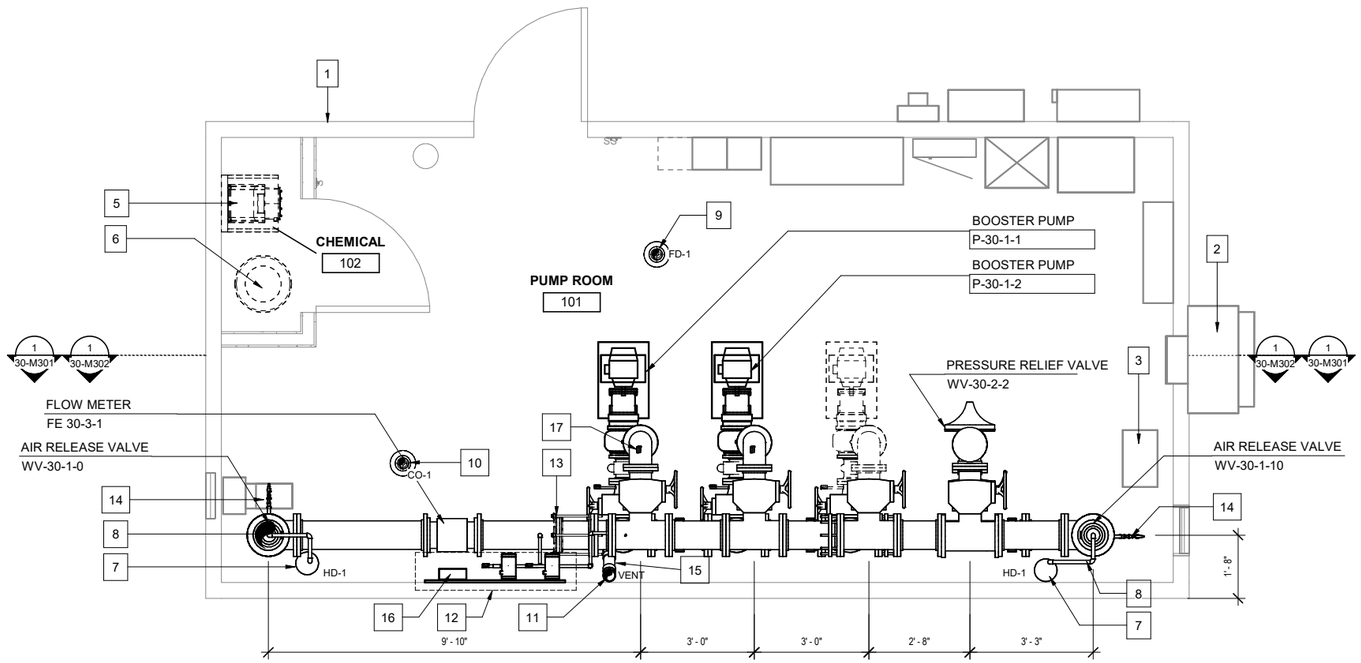
NOTE: PUMPSCHEDULE IS PROVIDED AS A GENERAL REFERENCE. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	PHASE/VOLTAGE	MODEL	COMMENTS
P-30-1-1	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
P-30-1-2	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
PIT 30-4-1	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS
PIT 30-4-2	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS

APPURTENANCES SCHEDULE - PROPOSED

NOTE: APPURTENANCE SCHEDULE IS PROVIDED AS A GENERAL REFERENCE. APPURTENANCES (NOT SHOWN) MAY BE REQUIRED TO COMPLETE THE PROJECT. CONTRACTOR IS REQUIRED TO PROVIDE A COMPLETE AND OPERABLE SYSTEM. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	APPURTENANCE	ABBREVIATION	SIZE	COMMENTS
30-WV-2-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
FE 30-3-1	FLOW METER	FE	16"ø-16"ø	MOUNT TRANSMITTER TO INSTRUMENT PANEL
WV-30-1-0	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-1-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-2	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-4	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-5	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-6	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-7	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-9	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-10	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-2-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-2-2	PRESSURE RELIEF VALVE	PRV	6"ø-6"ø	CLA-VAL MODEL 90-01 , REFER TO DIVISION 40 23 23 SPECIFICATIONS



PROCESS FLOOR PLAN

1/2" = 1'-0" (22"x24")
1/4" = 1'-0" (11"x17")
0 1 2 4

PLOT DATE: 11/17/2025 12:51:54 _ Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_MECH.rvt

PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY
	DESIGNED BY: JJY
	CHECKED BY: ATR

No	DATE	REVISIONS	BY

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WATER TOWER NO. 3 AND BOOSTER STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION
PROCESS FLOOR PLAN

PROJECT NO. 07985049.2
SHEET 30-M102

KEYNOTES:

1. PREFABRICATED BOOSTER STATION
2. HVAC UNIT BY BUILDING MANUFACTURER
3. FLOOR MOUNTED HIGH EFFECIENCY DEHUMIDIFIER BY STATION MANUFACTURER.
4. PROVIDE ALUMINUM RACK FOR MOUNTING OF PRESSURE MONITORING EQUIPMENT. MOUNT TO STATION WALL.
5. SMOOTH BORE SAMPLING TAP WITH ISOLATION BALL VALVE, SEE DETAIL
6. PRESSURE TRANSMITTER (PROVIDED BY DIVISION 26) AND GAUGE. MOUNT TO PRESSURE MONITORING PANEL. SECURE PIPING TO WALL AND RACK.
7. SUCTION PRESSURE GAUGE WITH ISOLATION BALL VALVE. TYPICAL OF EACH PUMP LOOP.
8. DISCHARGE PRESSURE GAUGE WITH ISOLATION BALL VALVE. TYPICAL OF EACH PUMP LOOP.
9. FLOW TRANSMITTER - MOUNTED TO INSTRUMENT PANEL

GENERAL NOTES:

A. BOOSTER STATION PROCESS PIPING 3"+ IS SHOWN AS FLANGED CLASS 53 DUCTILE IRON. REFER TO SPECIFICATOINS FOR ALTERNATE PIPING MATERIAL.
B. FLANGED CONNECTION ARE SHOWN ON DRAWINGS, PACKAGED BOOSTER SKID SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER AND OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE.
D. FUTURE EQUIPMENT AND PIPING SHOWN AS DASHED LINEWORK IN VIEW.
E. PROVIDE ALL PIPE WITH STICKER OR PAINTED LABELS WITH FLOW DIRECTION ARROWS. REFER TO DIVISIN 40.
F. SUCTION SIDE PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4063 ROBOTIC BLUE, OR EQUAL. DISCHARGE (BOOSTED) PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4086 SAFETY BLUE, OR EQUAL.

PUMP/INSTRUMENT SCHEDULE - PROPOSED

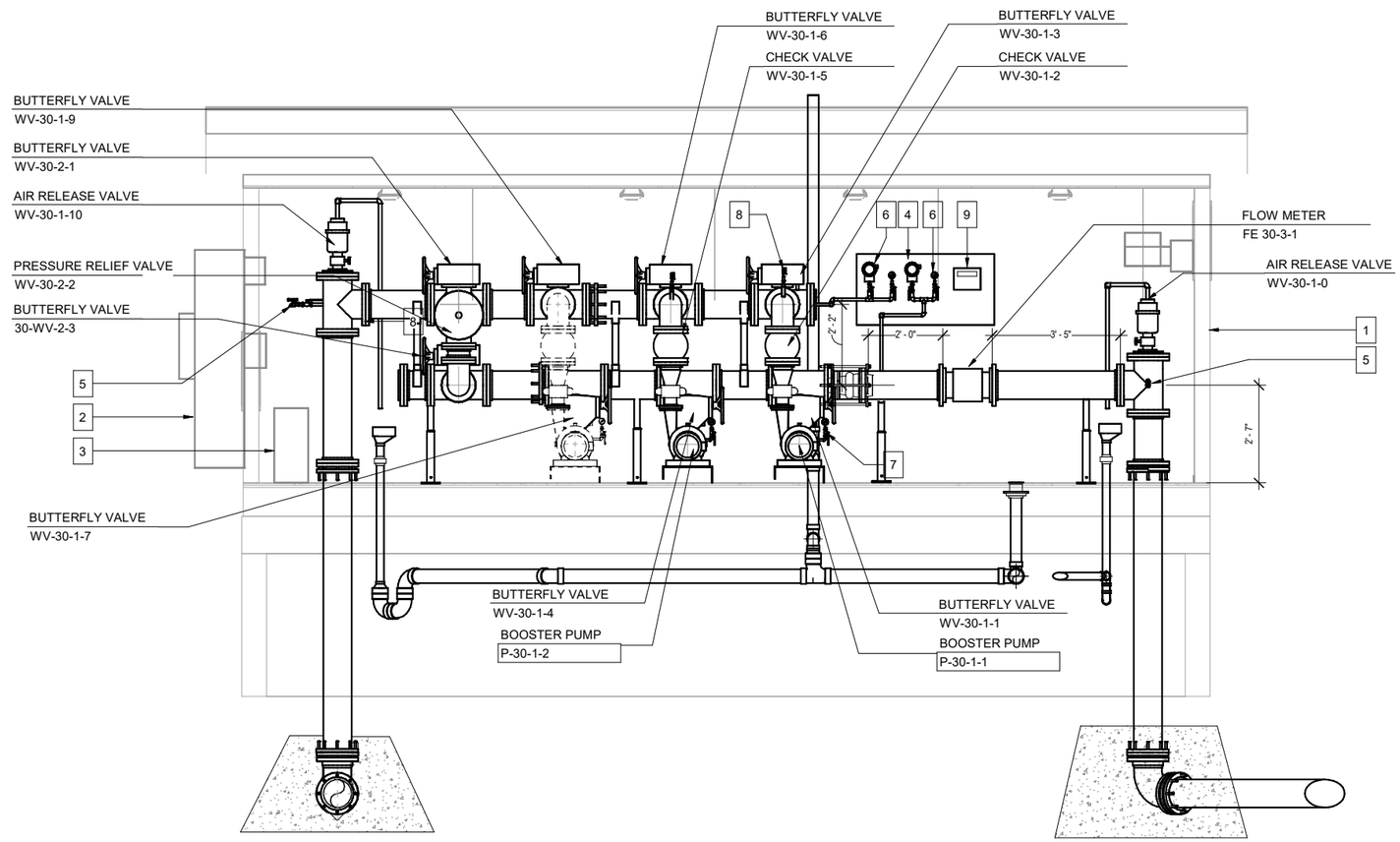
NOTE: PUMPSCHEDULE IS PROVIDED AS A GENERAL REFERENCE. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	PHASE/VOLTAGE	MODEL	COMMENTS
P-30-1-1	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
P-30-1-2	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
PIT 30-4-1	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS
PIT 30-4-2	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS

APPURTENANCES SCHEDULE - PROPOSED

NOTE: APPURTENANCE SCHEDULE IS PROVIDED AS A GENERAL REFERENCE. APPURTENANCES (NOT SHOWN) MAY BE REQUIRED TO COMPLETE THE PROJECT. CONTRACTOR IS REQUIRED TO PROVIDE A COMPLETE AND OPERABLE SYSTEM. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	APPURTENANCE	ABBREVIATION	SIZE	COMMENTS
30-WV-2-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
FE 30-3-1	FLOW METER	FE	16"ø-16"ø	MOUNT TRANSMITTER TO INSTRUMENT PANEL
WV-30-1-0	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-1-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-2	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-4	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-5	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-6	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-7	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-9	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-10	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-2-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-2-2	PRESSURE RELIEF VALVE	PRV	6"ø-6"ø	CLA-VAL MODEL 90-01 , REFER TO DIVISION 40 23 23 SPECIFICATIONS



1 PREFABRICATED BUILDING SECTION - PROPOSED EQUIPMENT
30-M301 1/2" = 1'-0" (22"x24") 1/4" = 1'-0" (11"x17") 0 1 2 4

PLOT DATE: 11/17/2025 12:51:56 - Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_MECH.rvt

PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	No	DATE	REVISIONS	BY
	DESIGNED BY: JJY				
	CHECKED BY: ATR				

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WATER TOWER NO. 3 AND BOOSTER STATION
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NORTH BOOSTER STATION
PREFABRICATED BUILDING SECTION

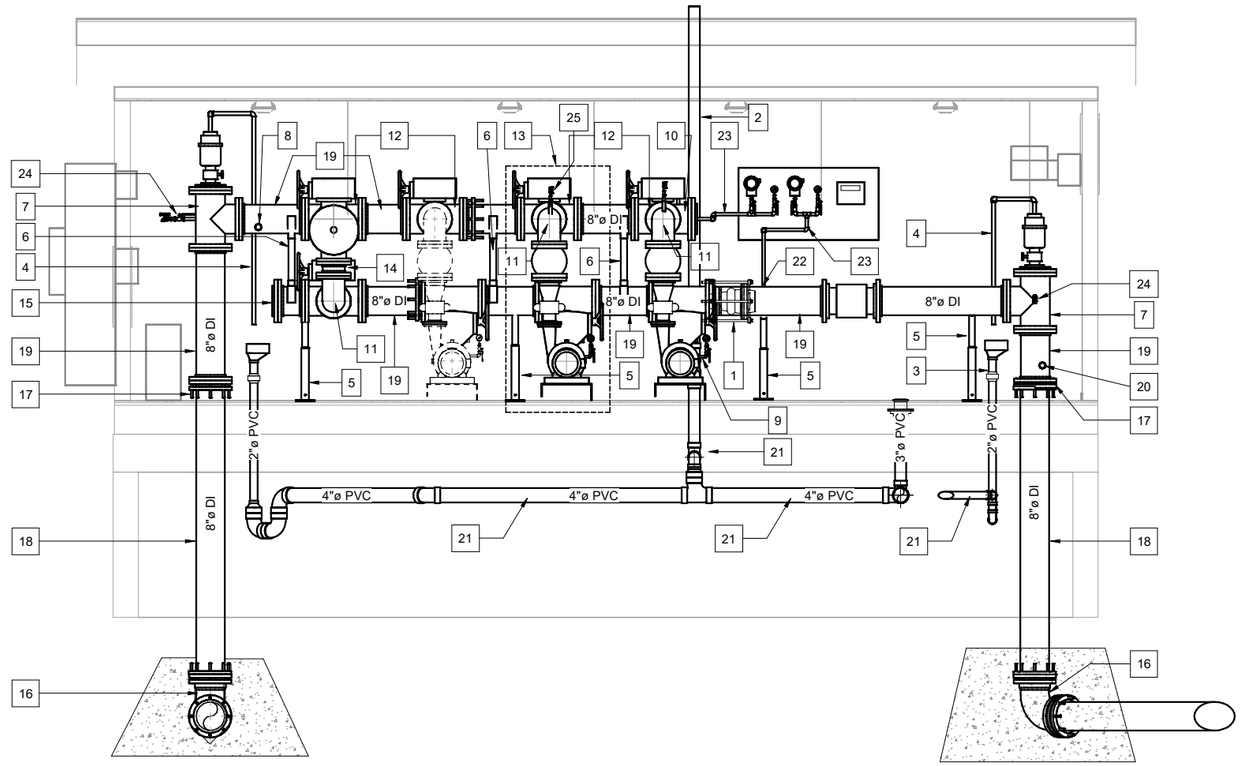
PROJECT NO. 07985049.2
SHEET 30-M301

KEYNOTES:

1. 6-INCH RESTAINED EXPANSION JOINT FITTING
2. 3-INCH PVC VENT TERMINAL. SECURE TO WALL. PROVIDE ROOF PENETRATION.
3. HUB DRAIN FOR PROCESS DISCHARGE, SEE DETAIL
4. 1" COPPER AIR RELEASE VALVE DISCHARGE PIPING - ROUTE TO HUB DRAIN
5. PIPE SUPPORT - FLOOR MOUNTED
6. PIPE SUPPORT - DOUBLE SADDLE TYPE
7. 8"X8"x8" DI TEE WITH BLIND FLANGE TAPPED FOR 2-INCH AIR RELEASE VALVE PIPING
8. 1" NPT TAP FOR FUTURE CHEMICAL INJECTION. TAP SHALL INSTALLED AT A 45 DEGREE ANGLE FROM HORIZONTAL ORIENTED UP FROM THE BOTTOM OF THE PIPE. PLUG TAP
9. 1/2" TAP AND PRESSURE GAUGE AT SUCTION AND DISCHARGE PIPING OF PUMPS. PROVIDE ISOLATION BALL VALVE UPSTREAM OF INSTRUMENT
10. 8"X8"X6" DI REDUCING TEE WITH 8-INCH BLIND FLANGE. PROVIDE 1" NPT TAP FOR PRESSURE MONTORING.
11. 6" DI 90 DEGREE ELBOW
12. 8"X8"X6" DI REDUCING TEE
13. SEE TYPICAL PUMP DETAIL FOR PIPING INFORMATION
14. 6" DI SPOOL PIPE OR FILLER FLANGE AS REQ'D FOR PRESSURE RELIEF VALVE CONNECTION.
15. 8" SPOOL AND BLIND FLANGE FOR SUCTION HEADER PIPING
16. 8" DI 90 DEGREE ELBOW (BELOW GRADE MECHANICAL JOINT). PROVIDE CONCRETE THRUST BLOCK PER CIVIL STANDARD DETAILS. RESTRAIN WITH TANDEM MEGA-LUG MECHANICAL JOINT RESTRAINT
17. RESTAINED FLANGE ADPATER (MEGA-FLANGE). CONNECTION SHALL BE PROVIDED IN THE FIELD BETWEEN CONTRACTOR'S BELOW GRADE PIPING AND SUPPLIER'S PREFABRICATED STATION PIPING.
18. 8-INCH CLASS 53, MECHANICALLY JOINTED, DUCTILE IRON PIPE FOR BELOW GRADE WATERMAIN (BY UTILITY CONTRACTOR)
19. 8-INCH CLASS 53 FLANGED DUCTILE IRON PIPE (BY STATION MANUFACTURER)
20. 1" NPT TAP FOR FUTURE CHLORINE ANALYZER FEED EQUIPMENT. PLUG TAP
21. BELOW SLAB PVC DRAIN PIPING (BY UTILITY CONTRACTOR)
22. 1" NPT TAP FOR SUCTION PRESSURE INSTRUMENTS
23. 1" COPPER PIPING AND ISOLATION BALL VALVES FOR PRESSURE MONITORING EQUIPMENT.
24. 1/2" TAP AND SMOOTH BORE SAMPLE TAP. PROVIDE ISOLATION BALL VALVE UPSTREAM OF FIXTURE. SAMPLE TAP SHALL BE STAINLESS STEEL OR CHROME.

GENERAL NOTES:

A. BOOSTER STATION PROCESS PIPING 3"+ IS SHOWN AS FLANGED CLASS 53 DUCTILE IRON. REFER TO SPECIFICATOINS FOR ALTERNATE PIPING MATERIAL.
B. FLANGED CONNECTION ARE SHOWN ON DRAWINGS, PACKAGED BOOSTER SKID SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER AND OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE.
D. FUTURE EQUIPMENT AND PIPING SHOWN AS DASHED LINEWORK IN VIEW.
E. PROVIDE ALL PIPE WITH STICKER OR PAINTED LABELS WITH FLOW DIRECTION ARROWS. REFER TO DIVISIN 40.
F. SUCTION SIDE PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4063 ROBOTIC BLUE, OR EQUAL. DISCHARGE (BOOSTED) PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4086 SAFETY BLUE, OR EQUAL.



1 / 30-M302 **PREFABRICATED BUILDING SECTION - PROPOSED PIPING**

1/2" = 1'-0" (22"x24")
1/4" = 1'-0" (11"x17")
0 1 2 4

PLOT DATE: 11/17/2025 12:51:58 PM | Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049 New Richmond Booster_M5CH.rvt

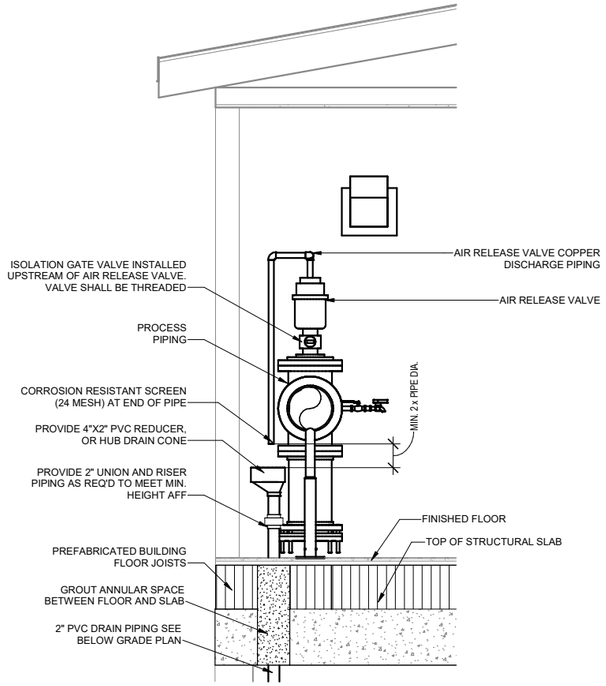
PROJECT DATE: NOVEMBER 18, 2025	DRAWN BY: JJY	No	DATE	REVISIONS	BY
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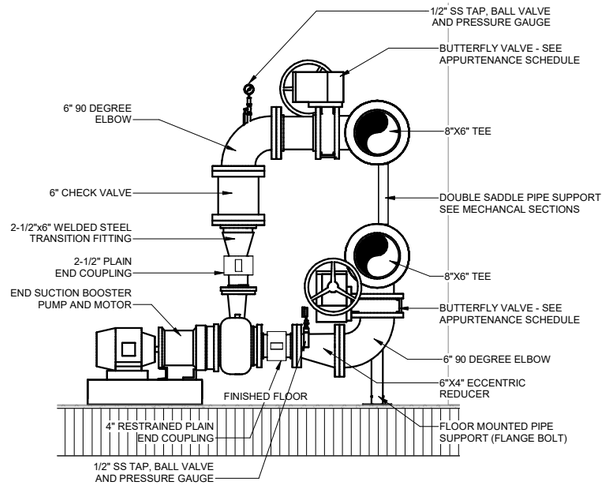
NORTH BOOSTER STATION
PREFABRICATED BUILDING SECTIONS

PROJECT NO. 07985049.2
SHEET 30-M302



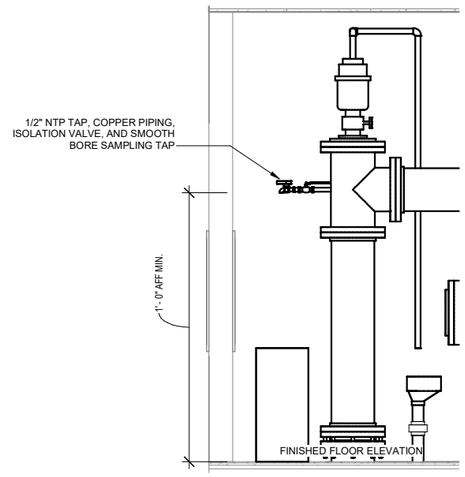
1 HUB DRAIN DETAIL

30-M501 NOT TO SCALE



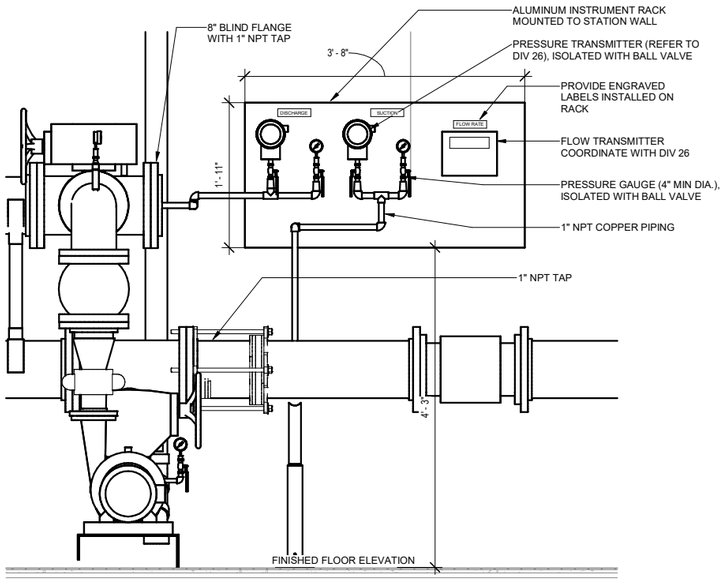
2 TYPICAL PUMP INSTALLATION

30-M501 NOT TO SCALE



3 TYPICAL SAMPLE TAP INSTALLATION

30-M501 NOT TO SCALE



4 INSTRUMENT PANEL DETAIL

30-M501 NOT TO SCALE

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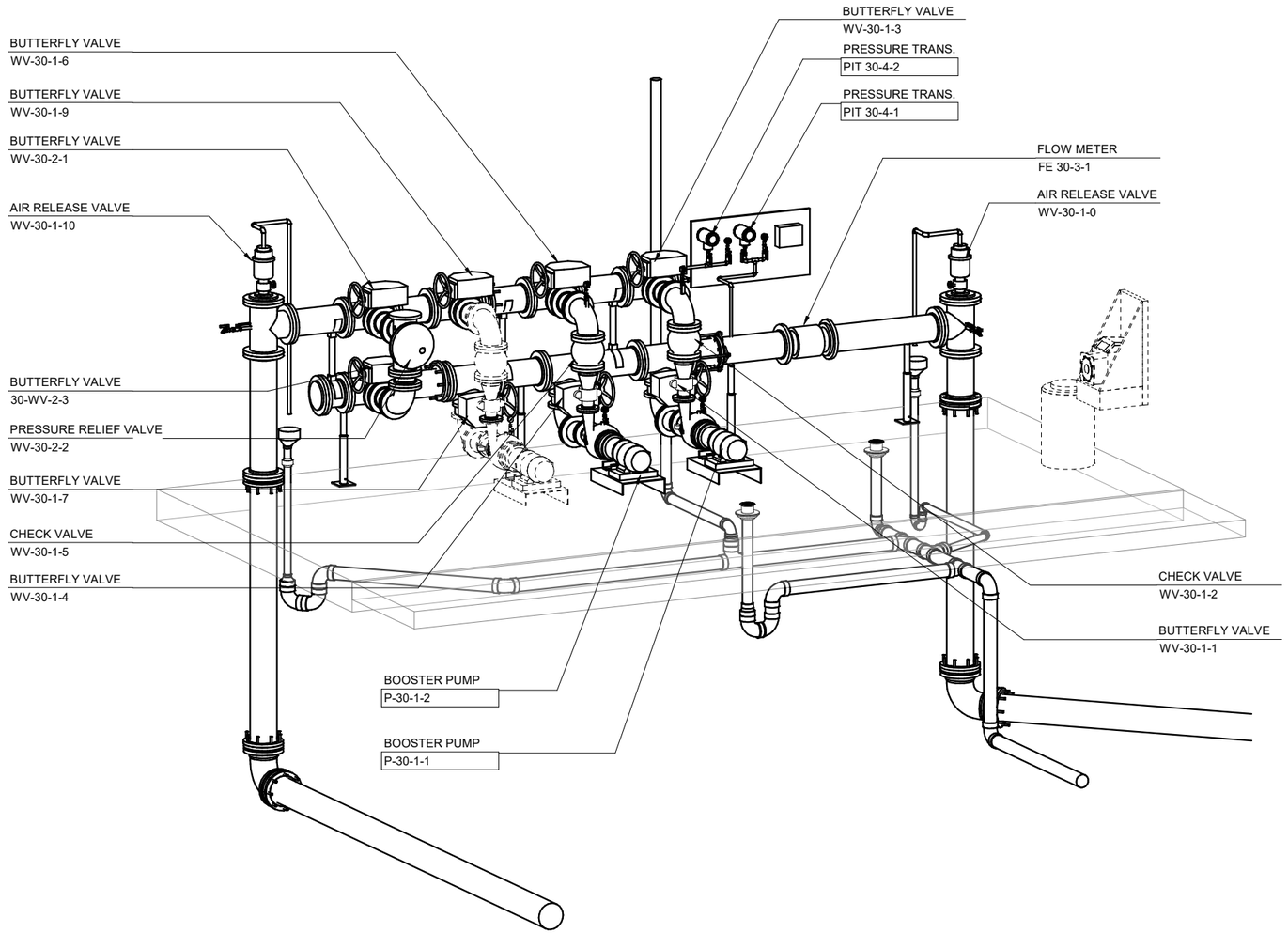
WATER TOWER NO. 3 AND BOOSTER STATION
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ST. CROIX COUNTY, WISCONSIN

NORTH BOOSTER STATION PROCESS DETAILS

PROJECT NO. 07985049.2
SHEET 30-M501

GENERAL NOTES:

A. BOOSTER STATION PROCESS PIPING 3"+ IS SHOWN AS FLANGED CLASS 53 DUCTILE IRON. REFER TO SPECIFICATOINS FOR ALTERNATE PIPING MATERIAL.
B. FLANGED CONNECTION ARE SHOWN ON DRAWINGS, PACKAGED BOOSTER SKID SUPPLIER MAY SUBSTITUTE WELDED CONNECTIONS, AND FITTINGS AND BENDS IN LOCATIONS APPROVED BY ENGINEER AND OWNER.
C. ALL BUTTERFLY VALVES SHALL BE LUGGED STYLE.
D. FUTURE EQUIPMENT AND PIPING SHOWN AS DASHED LINEWORK IN VIEW.
E. PROVIDE ALL PIPE WITH STICKER OR PAINTED LABELS WITH FLOW DIRECTION ARROWS. REFER TO DIVISIN 40.
F. SUCTION SIDE PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4063 ROBOTIC BLUE, OR EQUAL. DISCHARGE (BOOSTED) PROCESS PIPING SHALL BE PAINTED SHERWIN WILLIAMS 4086 SAFETY BLUE, OR EQUAL.



1 30-M901 **PROCESS MECHANICAL ISOMETRIC - EQUIPMENT PLAN**
NOT TO SCALE

PUMP/INSTRUMENT SCHEDULE - PROPOSED

NOTE: PUMPSCHEDULE IS PROVIDED AS A GENERAL REFERENCE. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	PHASE/VOLTAGE	MODEL	COMMENTS
P-30-1-1	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
P-30-1-2	3 PH/ 480V	GOULDS MODEL 16BF	SEE DETAIL FOR TYPICAL PUMP INSTALLATION
PIT 30-4-1	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS
PIT 30-4-2	1 PH/ 120V	SEE DIV 26	REFER TO DIVISION 26 SPECIFICATIONS AND DETAILS

APPURTENANCES SCHEDULE - PROPOSED

NOTE: APPURTENANCE SCHEDULE IS PROVIDED AS A GENERAL REFERENCE. APPURTENANCES (NOT SHOWN) MAY BE REQUIRED TO COMPLETE THE PROJECT. CONTRACTOR IS REQUIRED TO PROVIDE A COMPLETE AND OPERABLE SYSTEM. CONTRACTOR SHALL VERIFY ANY INFORMATION LISTED AND NOTIFY ENGINEER OF ANY CONFLICTS, DISCREPANCIES, OR MISSING INFORMATION.

TAG ID	APPURTENANCE	ABBREVIATION	SIZE	COMMENTS
30-WV-2-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
FE 30-3-1	FLOW METER	FE	16"ø-16"ø	MOUNT TRANSMITTER TO INSTRUMENT PANEL
WV-30-1-0	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-1-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-2	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-3	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-4	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-5	CHECK VALVE	CV	6"ø-6"ø	
WV-30-1-6	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-7	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-9	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-1-10	AIR RELEASE VALVE	ARV	2"ø-2"ø	PROVIDE ISOLATION BALL VALVE UPSTREAM OF ARV. ROUTE DISCHARGE PIPING TO HUB DRAIN
WV-30-2-1	BUTTERFLY VALVE	BFV	6"ø-6"ø	LUGGED STYLE W/ HANDWHEEL OPERATOR
WV-30-2-2	PRESSURE RELIEF VALVE	PRV	6"ø-6"ø	CLA-VAL MODEL 90-01 , REFER TO DIVISION 40 23 23 SPECIFICATIONS

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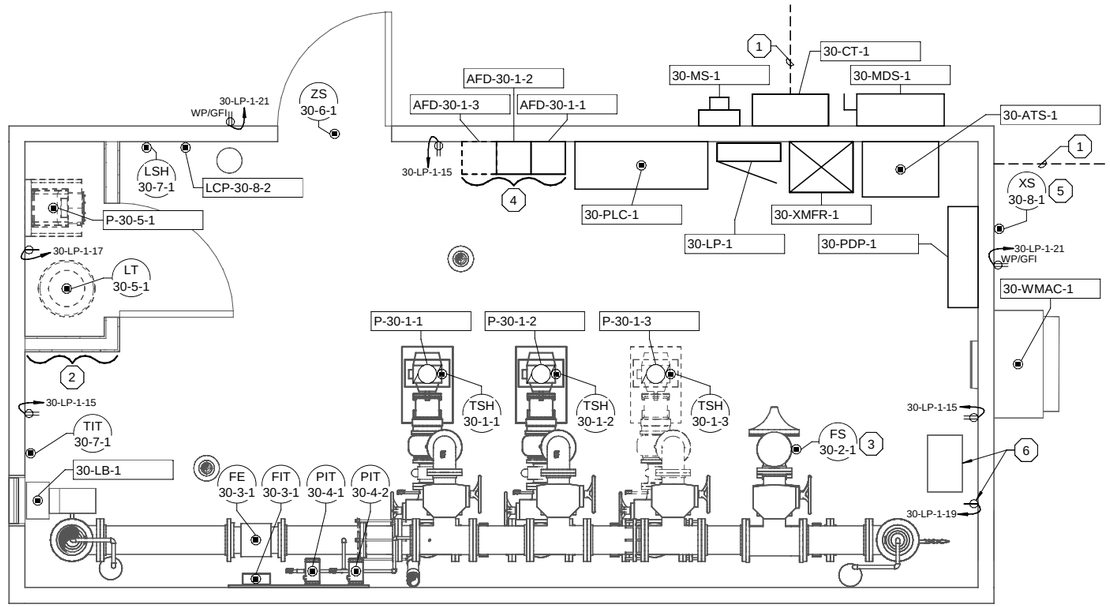
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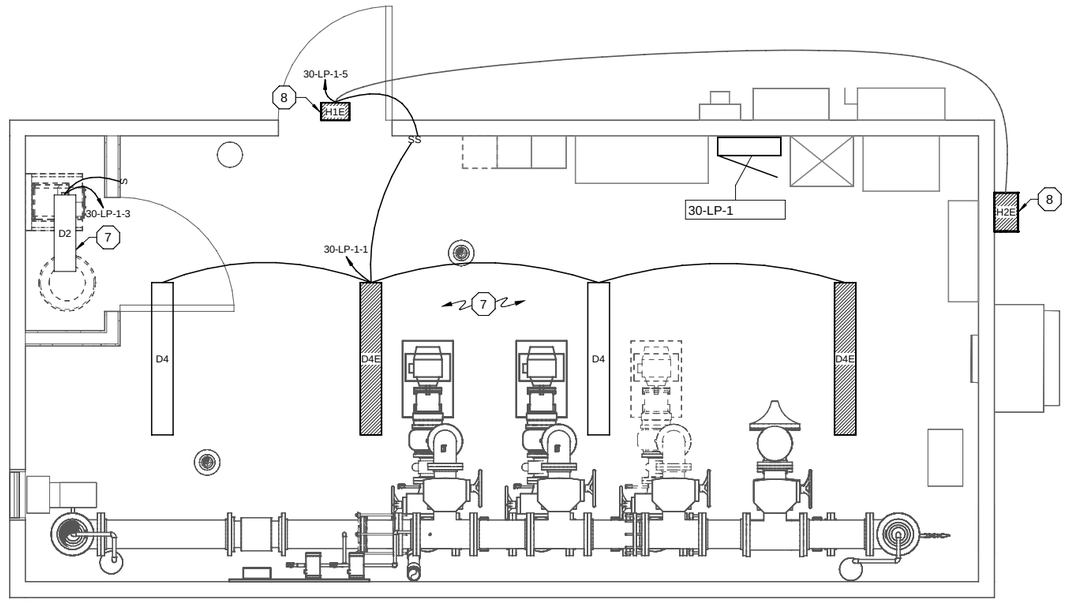
NORTH BOOSTER STATION
PROCESS ISOMETRICS

PROJECT NO. 07985049.2
SHEET 30-M901



POWER AND INSTRUMENTATION PLAN

1/2" = 1'-0" (22" x 34")
1/4" = 1'-0" (11" x 17")
0 1 2 4



LIGHTING PLAN

1/2" = 1'-0" (22" x 34")
1/4" = 1'-0" (11" x 17")
0 1 2 4

GENERAL NOTES

A. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER BEFORE CONTINUING WITH CONSTRUCTION.

B. ALL ELECTRICAL INSTALLATIONS SHALL MEET NEC REQUIREMENTS FOR MINIMUM WORKING SPACE IN FRONT OF EQUIPMENT AND DEDICATED EQUIPMENT SPACE ABOVE SWITCHBOARDS, SWITCHGEAR, PANELBOARDS AND MOTOR CONTROL CENTERS. COORDINATE LAYOUT OF ALL ELECTRICAL EQUIPMENT PRIOR TO INSTALLATION.

C. 120V HOMERUN WIRING SHALL BE A MINIMUM OF (2) #12 & #12G OR AS NOTED OTHERWISE. SIZE FOR VOLTAGE DROP.

D. CONDUIT SHALL BE 3/4" MINIMUM OR AS NOTED OTHERWISE.

E. CONDUIT WALL AND FLOOR PENETRATIONS PER DETAILS 2605-303 AND 2605-305.

F. SEE ONE-LINE DIAGRAMS, PANEL SCHEDULES, AND ELECTRICAL INSTALLATION AND WIRING SCHEDULES FOR WIRING OF ALL FIELD INSTRUMENTATION AND EQUIPMENT.

G. INSTALL FIELD INSTRUMENTATION AND EQIUPMENT PER DETAIL REFERENCED IN ELECTRICAL INSTALLATION AND WIRING SCHEDULES.

H. SEE SCADA SYSTEM NETWORK ARCHITECTURE FOR COMMUNICATIONS CABLING REQUIREMENTS.

I. PROVIDE RACEWAY FOR ALL HVAC EQUIPMENT. PROVIDE WIRING FOR LINE VOLTAGE AND ABOVE POWER AND CONTROL WIRING.

J. DISCONNECTS RELATED TO HVAC AND PLUMBING CONNECTIONS SHALL BE FURNISHED BY EQUIPMENT SUPPLIER AND INSTALLED BY THE ELECTRICAL CONTRACTOR.

K. ALL INTERIOR RECEPTACLES TO BE MOUNTED 22" ABOVE FINSIHED FLOOR TO CENTERLINE, EXCEPT WHERE NOTED OTHERWISE.

L. ALL EXTERIOR RECEPTACLES TO BE GFCI WEATHERPROOF "WHILE IN USE" TYPE COVER MOUNTED AT 30" ABOVE FINISHED GRADE TO CENTERLINE.

M. MOUNT LIGHT SWITCHES AT 42" ABOVE FINSIHED FLOOR TO CENTERLINE. ALL SWITCHES IN CLASSIFIED LOCATIONS SHALL BE EXPLOSION PROOF.

N. SHADED FIXTURE (▨) OR FIXTURE TAG SUFFIXED WITH "E" INDICATES EMERGENCY FIXTURE. REFER TO FIXTURE SCHEDULE.

O. ROOM/AREA ATMOSPHERE REQUIREMENTS, REFER TO SECTION 26 05 00:
   a. NORTH B.S. SITE EXTERIOR: GENERAL, WET, NEW CONSTRUCTION
   b. NORTH B.S. PUMP ROOM: GENERAL, DAMP, NEW CONSTRUCTION
   c. NORTH B.S. CHEMICAL CLOSET: CORROSIVE, DAMP, NEW CONSTRUCTION

KEY NOTES ⓧ

1 APPROXIMATE LOCATION OF NEW DIRECT BURIED CONDUITS. REFER TO ELECTRICAL SITE PLAN FOR CONSTRUCTION DETAILS AND CONDUIT REQUIREMENTS.

2 WALL SPACE RESERVED FOR FUTURE CHLORINE ANALYZER.

3 LOCATE FLOW SWITCH IN THE ELBOW OF THE PROCESS PIPING ON THE OUTLET SIDE OF THE PRESSURE REDUCING VALVE. FLOW SWITCH SHALL BE CONFIGURED TO TRIP ONLY WHEN THERE IS FLOW THROUGH THE PRESSURE REDUCING VALVE AND SHALL NOT HAVE FALSE READINGS.

4 WALL MOUNTED ADJUSTABLE FREQUENCY DRIVE AS SPECIFIED. INSTALL PER DETAIL 2690-800 AND PER MANUFACTURER REQUIREMENTS. PROVIDE ENOUGH REMAINING WALL SPACE TO ACCOMODATE THE FUTURE INSTALLATION OF A THIRD DRIVE.

5 PROVIDE CLEAR, HINGED COVER FOR GENERATOR E-STOP PUSHBUTTON. GENERATOR E-STOP ENCLOSURE SHALL BE RATED NEMA 4X.

6 RECEPTACLE DEDICATED TO DEHUMIDIFIER. COORDINATE LOCATION WITH OWNER.

7 MOUNT FIXTURES IN THIS ROOM TIGHT TO CEILING.

8 MOUNT FIXTURE 7'-2" ABOVE FINISHED FLOOR ELEVATION TO BOTTOM OF FIXTURE.

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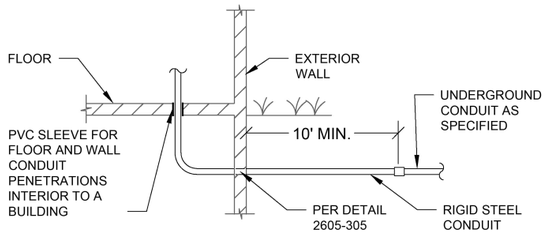
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NORTH BOOSTER STATION ELECTRICAL PLANS

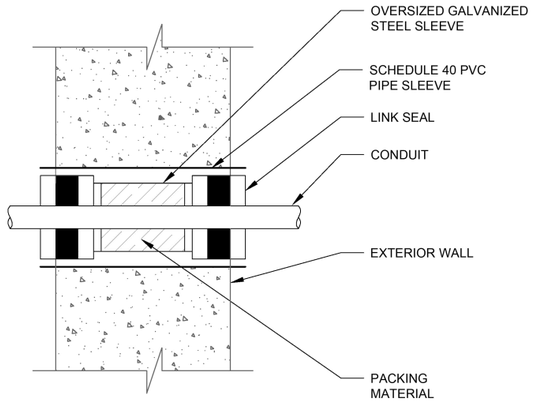
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SHEET 30-E101



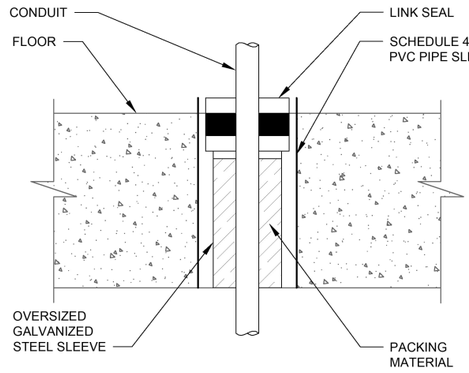
CONDUIT INSTALLATION, INTERIOR WALL AND FLOOR PENETRATIONS AND EXTERIOR DIRECT BURIED INTO A NEW SPACE

NTS

2605-303



FOUNDATION WALL PENETRATION

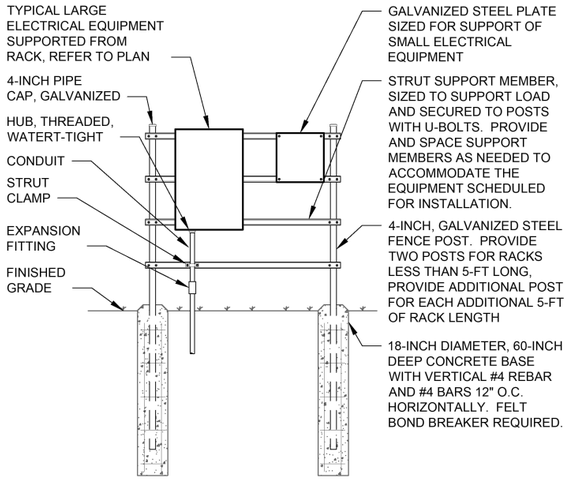


FLOOR PENETRATION

CONDUIT WALL AND FLOOR PENETRATIONS WHERE WATER IS PRESENT

NTS

2605-305



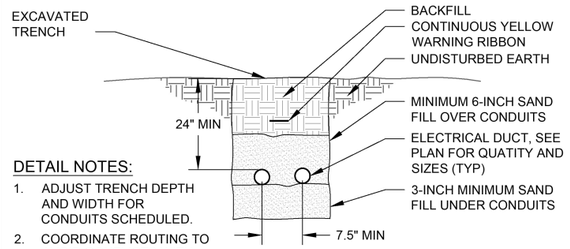
DETAIL NOTES:

1. REFER TO PLAN, FOR LOCATION, ORIENTATION, AND IDENTIFICATION OF EQUIPMENT SCHEDULED FOR INSTALLATION ON RACK..
2. CONTRACTOR SHALL VERIFY THAT SELECTED COMPONENTS ARE SUITABLE FOR THE WEIGHT OF THE MOUNTED EQUIPMENT.
3. SUPPORT MEMBERS SHALL BE CONSTRUCTED OF GALVANIZED OR STAINLESS STEEL AS SPECIFIED. ALL HARDWARE SHALL BE CONSTRUCTED OF STAINLESS STEEL.

SUPPORT HARDWARE INSTALLATION EXTERIOR FREE-STANDING RACK

NTS

2605-400



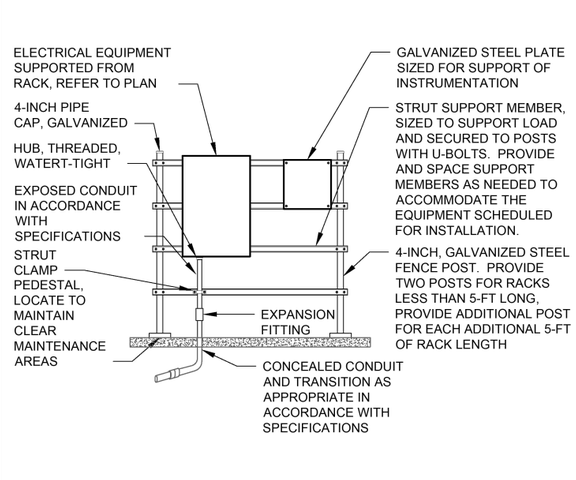
DETAIL NOTES:

1. ADJUST TRENCH DEPTH AND WIDTH FOR CONDUITS SCHEDULED.
2. COORDINATE ROUTING TO AVOID CONFLICTS WITH MECHANICAL PIPING.

RACEWAY INSTALLATION UNDERGROUND, DIRECT-BURIED

NTS

2605-310



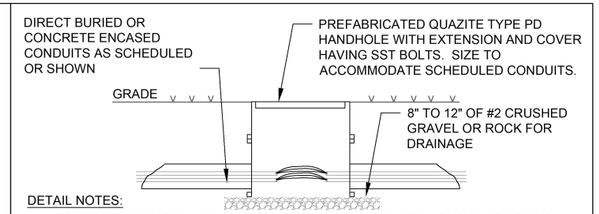
DETAIL NOTES:

1. REFER TO PLAN, FOR LOCATION, ORIENTATION, AND IDENTIFICATION OF EQUIPMENT SCHEDULED FOR INSTALLATION ON RACK..
2. CONTRACTOR SHALL VERIFY THAT SELECTED COMPONENTS ARE SUITABLE FOR THE WEIGHT OF THE MOUNTED EQUIPMENT.
3. SUPPORT MEMBERS SHALL BE CONSTRUCTED OF GALVANIZED OR STAINLESS STEEL AS SPECIFIED. ALL HARDWARE SHALL BE CONSTRUCTED OF STAINLESS STEEL.

SUPPORT HARDWARE INSTALLATION INTERIOR FREE-STANDING RACK

NTS

2605-401



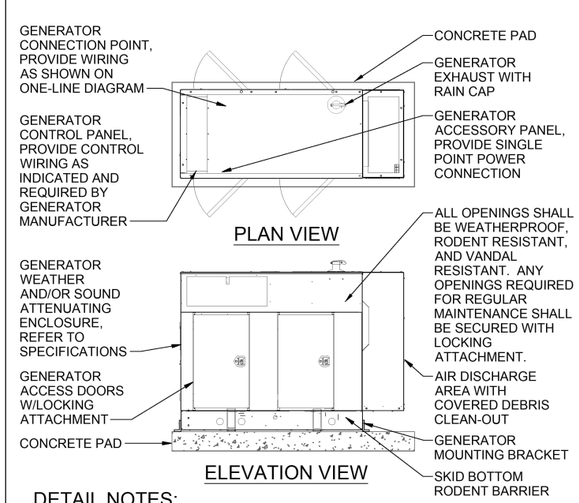
DETAIL NOTES:

1. REAM AND THREAD ALL CONDUIT ENDS AT PULL BOX. INSTALL BUSHINGS OR END BELLS ON METALLIC/NON-METALLIC CONDUITS RESPECTIVELY PRIOR TO PULLING IN NEW WIRE. SEAL CONDUITS WITH DUCT-SEAL OR EQUAL.
2. DO NOT MAKE SPLICES WITHOUT ENGINEER APPROVAL. SPLICE KITS WHEN ALLOWED SHALL BE INSULATING, MOISTURE-SEALING ELECTRICAL SPLICE-KITS SUITABLE FOR USE WITH CABLE AND WIRE TYPES INSTALLED, "SCOTCH-CAST" OR EQUAL.

EXTERIOR HANDHOLE INSTALLATION

NTS

2605-550



PLAN VIEW



ELEVATION VIEW

DETAIL NOTES:

1. INSTALL GENERATOR PER MANUFACTURER'S INSTRUCTIONS, IN ACCORDANCE WITH ALL CODES, AND ON CONCRETE ISOLATION PAD, REFER TO ELECTRICAL/ARCHITECTURAL/STRUCTURAL/CIVIL PLANS FOR DIMENSIONS.
2. REFER TO SITE PLAN FOR LOCATION AND ORIENTATION.
3. MAINTAIN 3-FT MINIMUM EQUIPMENT ACCESS AND MAINTENANCE CLEARANCE ON ALL SIDES OF GENERATOR.

PERMANENT GENERATOR EXTERIOR INSTALLATION

NTS

2632-301

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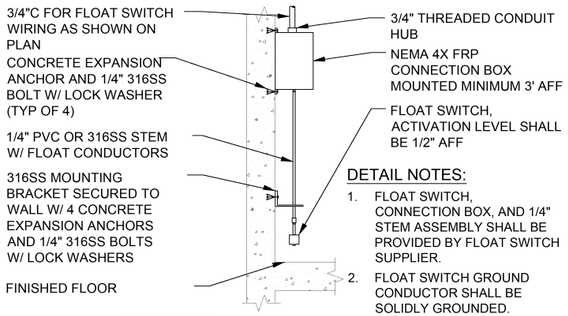
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BOOSTER STATION AND PRV STATION
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ELECTRICAL DETAILS

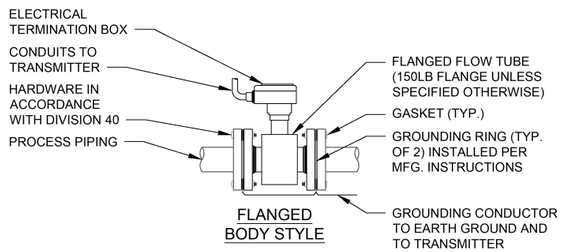
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SHEET 99-E501



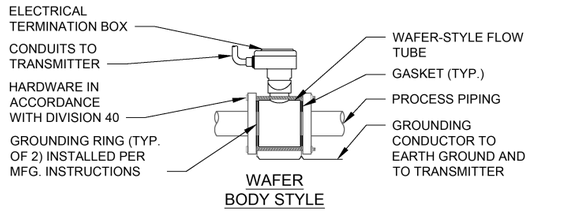
DETAIL NOTES:

1. FLOAT SWITCH, CONNECTION BOX, AND 1/4" STEM ASSEMBLY SHALL BE PROVIDED BY FLOAT SWITCH SUPPLIER.
2. FLOAT SWITCH GROUND CONDUCTOR SHALL BE SOLIDLY GROUNDED.

2690-080 FLOAT SWITCH INSTALLATION DRY WELL
NTS



FLANGED BODY STYLE



WAFER BODY STYLE

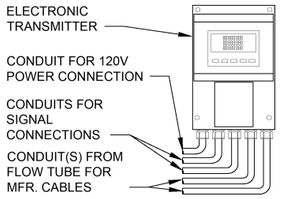
DETAIL NOTES:

1. INSTALL FLOW METER TO MAINTAIN STRAIGHT RUN OF 5 UPSTREAM PIPE DIAMETERS AND 2 DOWNSTREAM PIPE DIAMETERS, MINIMUM.
2. INSTALL CONDUIT(S) BETWEEN FLOW TUBE AND TRANSMITTER IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. ALL CABLES SHALL BE INSTALLED IN CONDUIT.
4. INSULATED GROUND CONDUCTOR NEED NOT BE INSTALLED IN CONDUIT.
5. GROUNDING SYSTEM SHALL PROVIDE LESS THAN 0.5 OHM, 100MV WHEN TESTED WITH STANDARD METHODS.

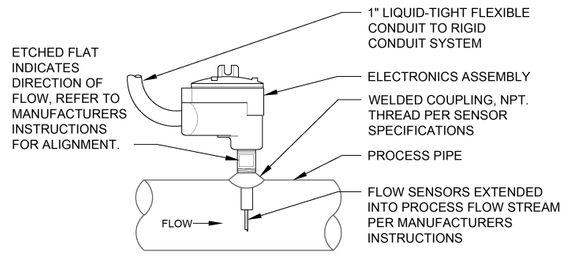
2690-100 INSTRUMENT INSTALLATION, ELECTROMAGNETIC FLOW SENSOR
NTS

DETAIL NOTES:

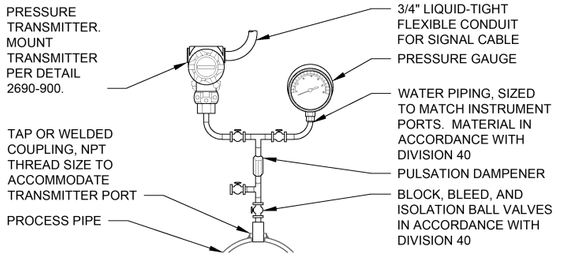
1. INSTALL CONDUIT(S) BETWEEN FLOW TUBE AND TRANSMITTER. CONDUIT(S) SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND MANUFACTURER'S WRITTEN INSTRUCTIONS.
2. ALL CABLES SHALL BE INSTALLED IN CONDUIT.
3. MOUNT TRANSMITTER ON WALL PER DETAIL 2690-900.
4. DISCRETE AND ANALOG SIGNAL CIRCUITS SHALL BE RUN IN SEPARATE CONDUITS.



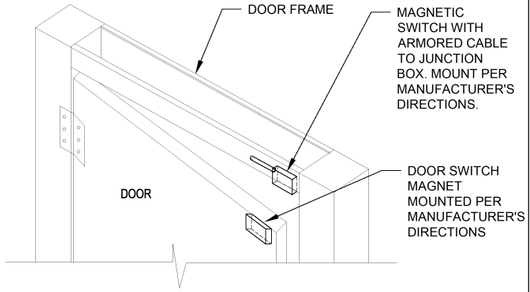
2690-101 INSTRUMENT INSTALLATION, ELECTRO-MAGNETIC REMOTE FLOW TRANSMITTER
NTS



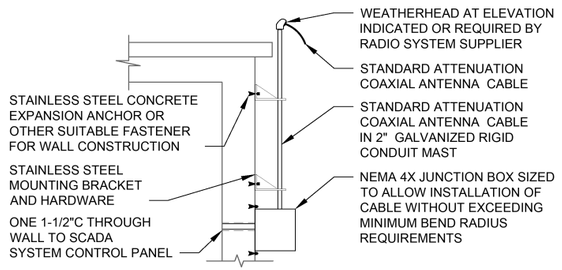
2690-151 INSTRUMENT INSTALLATION, THERMAL DISPERSION FLOW SWITCH
NTS



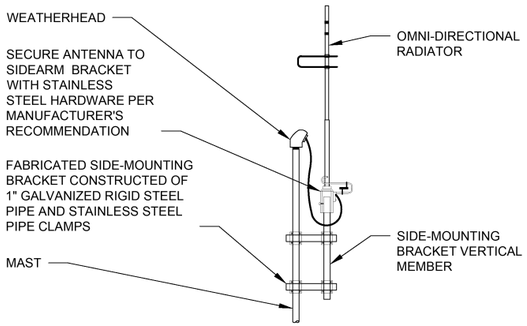
2690-301 INSTRUMENT INSTALLATION, PRESSURE TRANSMITTER/GAUGE
NTS



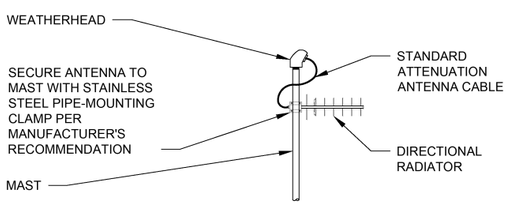
2690-601 INTRUSION ALARM DOOR SWITCH
NTS



2690-700 RF ANTENNA INSTALLATION, BUILDING SUPPORTED
NTS

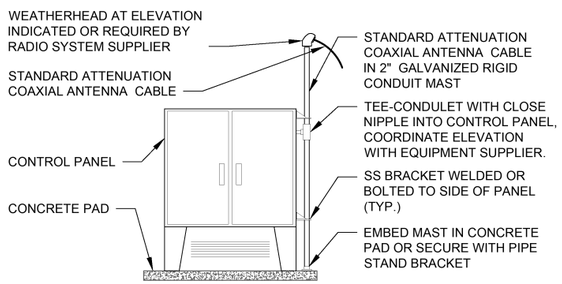


OMNI-DIRECTIONAL RADIATOR

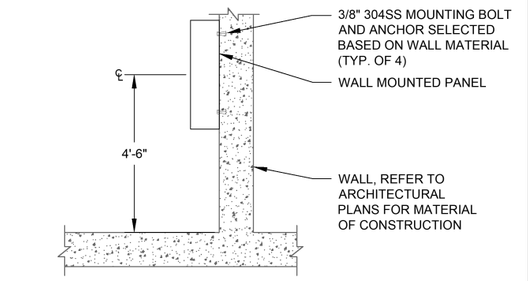


DIRECTIONAL RADIATOR

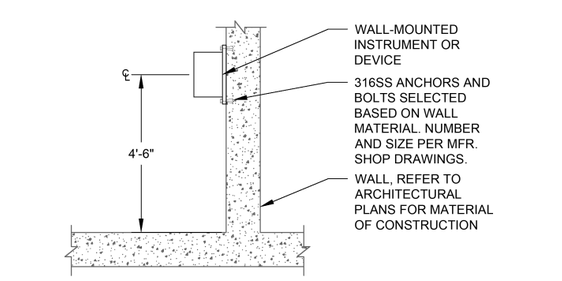
2690-701 RF RADIATOR INSTALLATION, MAST MOUNTED
NTS



2690-702 RF ANTENNA MOUNTING, CONTROL PANEL SUPPORTED
NTS



2690-800 CONTROL PANEL INSTALLATION WALL-MOUNTED
NTS



2690-900 CASE-MOUNTED DEVICE WALL-MOUNT INSTALLATION
NTS

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

ELECTRICAL DETAILS

PROJECT NO. 07985049.2
SHEET 99-E502

PANEL SCHEDULE - 20-PDP-1

TYPE: SQUARE D - NQ
MOUNT: SURFACE
ISOLATED GROUND BUS: Yes
GROUND BUS: Yes
LOCATION: PRV STATION STR-20
VOLTAGE: 120/240V 1P, 3W
BUS AMPACITY: 100 A
MAIN CIRCUIT BKR: 100 A
SUB FEED LUGS: No
AMPS AIC: 10 KAIC

CKT. NO.	TRIP/P	DESCRIPTION	A		B		DESCRIPTION	TRIP/P	CKT. NO.
1	20 A/1	Convenience Receptacle	1.5 A	0.0 A			20-PLC-1	20 A/1	2
3	20 A/2	20-UH-1			0.8 A	2.5 A	FIT-20-2-1	20 A/1	4
5			0.8 A	0.0 A			Spare	20 A/1	6
7	20 A/1	Spare			0.0 A	0.0 A	Spare	20 A/1	8
9	/1	Space	--	--			Space	/1	10
11	/1	Space			--	--	Space	/1	12
			280 VA		400 VA				
			2.3 A		3.3 A				

NOTES:
SERVICE ENTRANCE RATED PANEL. 20-PDP-1 SHALL BE INTEGRAL TO 20-PLC-1.

Load Classification	Connected Load	Demand Factor	Estimated...	Panel Totals	
Receptacles	180 VA	100.00%	180 VA		
HVAC	200 VA	100.00%	200 VA	**Total Conn. Load:**	680 VA
Process Equipment	300 VA	100.00%	300 VA	**Total Est. Demand:**	680 VA
				Total Conn. Current:	2.8 A
				Total Est. Demand...	2.8 A

PANEL SCHEDULE - 30-PDP-1

TYPE: SQUARE D - NF
MOUNT: SURFACE
ISOLATED GROUND BUS: No
GROUND BUS: Yes
LOCATION: NORTH BOOSTER STATIO...
VOLTAGE: 277/480V 3P, 4W
BUS AMPACITY: 400 A
MAIN CIRCUIT BKR: 400A
SUB FEED LUGS: No
AMPS AIC: 30 KAIC

CKT. NO.	TRIP/P	DESCRIPTION	A		B		C		DESCRIPTION	TRIP/P	CKT. NO.
1			3.7 A	34.0 A							2
3	90 A/3	30-XMFR-1			7.8 A	34.0 A			AFD-30-1-1	60 A/3	4
5							9.7 A	34.0 A			6
7			16.0 A	34.0 A							8
9	20 A/3	30-WMAC-1			16.0 A	34.0 A			AFD-30-1-2	60 A/3	10
11							16.0 A	34.0 A			12
13			0.0 A	0.0 A							14
15	20 A/3	Spare			0.0 A	0.0 A			Spare (Future AFD-30-1-3)	60 A/3	16
17							0.0 A	0.0 A			18
19			--	--							20
21	/3	Space			--	--			Space	/3	22
23							--	--			24
25			--	--							26
27	/3	Space			--	--			Space	/3	28
29							--	--			30
			24297 VA		25279 VA		25815 VA				
			87.7 A		91.8 A		93.7 A				

NOTES:

Load Classification	Connected Load	Demand Factor	Estimated...	Panel Totals	
Lighting	200 VA	125.00%	250 VA		
Receptacles	1680 VA	100.00%	1680 VA	**Total Conn. Load:**	75391 VA
Power	2808 VA	100.00%	2808 VA	**Total Est. Demand:**	75441 VA
HVAC	13377 VA	100.00%	13377 VA	**Total Conn. Current:**	90.7 A
Process Equipment	57327 VA	100.00%	57327 VA	**Total Est. Demand...**	90.7 A

PANEL SCHEDULE - 30-LP-1

TYPE: SQUARE D - NQ
MOUNT: SURFACE
ISOLATED GROUND BUS: No
GROUND BUS: Yes
LOCATION: NORTH BOOSTER STATIO...
VOLTAGE: 120/208V 3P, 4W
BUS AMPACITY: 100 A
MAIN CIRCUIT BKR: 100 A
SUB FEED LUGS: No
AMPS AIC: 10 KAIC

CKT. NO.	TRIP/P	DESCRIPTION	A		B		C		DESCRIPTION	TRIP/P	CKT. NO.
1	20 A/1	Pump Room Lights	1.3 A	4.0 A					30-PLC-1	20 A/1	2
3	20 A/1	Closet Light			0.2 A	2.5 A			FIT-30-3-1	20 A/1	4
5	20 A/1	Exterior Lights					0.2 A	0.1 A	FS-30-2-1	20 A/1	6
7	20 A/1	Spare	0.0 A	0.0 A					Spare	20 A/1	8
9	20 A/1	Spare			0.0 A	0.0 A			Spare	20 A/1	10
11	20 A/1	Spare					0.0 A	0.0 A	Spare	20 A/1	12
13	20 A/1	Spare	0.0 A	0.0 A					Spare	20 A/1	14
15	20 A/1	Interior Receptacles			8.0 A	0.6 A			30-LB-1	20 A/1	16
17	20 A/1	Chem. Pump Dedicated Rec.					1.5 A	6.0 A	* Gen. Battery Charger	20 A/1	18
19	20 A/1	Dehumidifier Dedicated Rec.	1.5 A	1.7 A					* Gen. Battery Heater	20 A/1	20
21	20 A/1	Exterior Receptacles			3.0 A	0.8 A			* Gen. Alternator Heater	20 A/1	22
23	20 A/1	Spare					0.0 A	12.5 A	* Gen. Coolant Heater	20 A/1	24
25	20 A/1	Spare	0.0 A	0.1 A					* Gen. Louvers	20 A/1	26
27	20 A/1	Spare			0.0 A	1.5 A			* Gen. Convenience Rec.	20 A/1	28
29	20 A/1	Spare					0.0 A	0.8 A	* Gen. Enclosure Light	20 A/1	30
			1019 VA		2001 VA		2536 VA				
			8.5 A		17.9 A		22.4 A				

NOTES:
* COORDINATE EXACT GENERATOR AUXILIARY COMPONENT CIRCUIT BREAKER AND WIRING REQUIREMENTS WITH GENERATOR SUBMITTAL.

Load Classification	Connected Load	Demand Factor	Estimated...	Panel Totals	
Lighting	200 VA	125.00%	250 VA		
Receptacles	1680 VA	100.00%	1680 VA	**Total Conn. Load:**	5555 VA
Power	2808 VA	100.00%	2808 VA	**Total Est. Demand:**	5605 VA
HVAC	75 VA	100.00%	75 VA	**Total Conn. Current:**	15.4 A
Process Equipment	793 VA	100.00%	793 VA	**Total Est. Demand...**	15.6 A

FIXTURE SCHEDULE

ID	QTY	DESCRIPTION	WATTS	LAMP TYPE	LAMP QTY.	MANUFACTURER	CATALOG NUMBER	NOTES
D2	1	2' SURFACE ENCLOSED INDUSTRIAL - WET LABEL	39 W	LED-4000K	W/FIX	LITHONIA	FEM L24 6000LM LPAFL WD MVOLT 40K 80CRI	
D4	2	4' SURFACE ENCLOSED INDUSTRIAL - WET LABEL	38 W	LED-4000K	W/FIX	LITHONIA	FEM L48 6000LM LPAFL WD MVOLT 40K 80CRI	
D4E	2	4' SURFACE ENCLOSED INDUSTRIAL - WET LABEL, EMERGENCY BATTERY PACK	38 W	LED-4000K	W/FIX	LITHONIA	FEM L48 6000LM LPAFL WD MVOLT 40K 80CRI E10WMCP	
H1E	1	EXTERIOR LED WALL PACK, DOWNWARD THROW, EMERGENCY BATTERY PACK	7 W	LED-5000K	W/FIX	LITHONIA	WDGE1 LED P0 50K 80CRI VF MVOLT SRM E4WH DDBTXD	1
H2E	1	EXTERIOR LED WALL PACK, FORWARD THROW, EMERGENCY BATTERY PACK	16 W	LED-5000K	W/FIX	LITHONIA	TWR1 LED ALO SWW2 UVOLT PE DDBTXD E7WC	1,2

GENERAL NOTES

A. ALL FIXTURES SHALL BE UNIVERSAL VOLTAGE ULNESS OTHERWISE INDICATED.
B. ALL LED FIXTURES SHALL BE DESIGNLIGHTS$_{TM}$ CONSORTIUM QUALIFIED.
C. FIXTURES BY MANUFACTURERS OTHER THAN THOSE SHOWN IN THE SCHEDULE SHALL BE CONSIDERED EQUAL PROVIDED THEY ARE OF SIMILAR QUALITY OF CONSTRUCTION AND HAVE ALL FEATURES, OPTIONS, AND ACCESSORIES AS THE SCHEDULED FIXTURE.

FIXTURE NOTES

1. TENATIVE FIXTURE COLOR SELECTION IS BRONZE. FINAL FIXTURE COLOR FROM STANDARD COLORS TO BE SELECTED BY THE ARCHITECT AND OWNER.
2. ADJUST DEFAULT OUT OF BOX SETTINGS TO LOW LUMEN OUTPUT AND 5000K COLOR SETTINGS. STANDARD DAWN-TO-DUSK OPERATION SHALL BE DISABLED.

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

PANEL & FIXTURE SCHEDULES

PROJECT NO. 07985049.2
SHEET 99-E601

PRV & BOOSTER STATION - EQUIPMENT ELECTRICAL INSTALLATION AND WIRING SCHEDULE

TAG NUMBER	DESCRIPTION	FIRST SIGNAL/CONTROL HOMERUN			SECOND SIGNAL/CONTROL HOMERUN			POWER HOMERUN			DETAIL	NOTES
		DESTINATION	WIRING TYPE	WIRING	DESTINATION	WIRING TYPE	WIRING	PANEL	CIRCUIT RATING	CIRCUIT WIRING		
STR-20												
PRV STATION												
20-UH-1	PRV STATION UNIT HEATER							20-PDP-1	240 V - 20 A / 2 P	2-#12, 1-#12, 1-#12		2
STR-30												
NORTH BOOSTER STATION												
30-WMAC-1	NORTH BOOSTER STATION WALL-MOUNT AIR CONDITIONER							30-PDP-1	480 V - 20 A / 3 P	3-#12, 1-#12, 1-#12		2
30-LB-1	NORTH BOOSTER STATION LOUVERED BLOWER							30-LP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12		2
P-30-1-1	BOOSTER PUMP NO.1							AFD-30-1-1	480 V - 20 A / 3 P	3-#12, 1-#12, 1-#12		2,7
P-30-1-2	BOOSTER PUMP NO.2							AFD-30-1-2	480 V - 20 A / 3 P	3-#12, 1-#12, 1-#12		2,7
P-30-1-3	BOOSTER PUMP NO.3											6
P-30-5-1	HYPOCHLORITE CHEMICAL PUMP											6

PRV & BOOSTER STATION - PROCESS INSTRUMENTATION ELECTRICAL INSTALLATION AND WIRING SCHEDULE

TAG NUMBER	DESCRIPTION	FIRST SIGNAL/CONTROL HOMERUN			SECOND SIGNAL/CONTROL HOMERUN			POWER HOMERUN			DETAIL	NOTES
		DESTINATION	WIRING TYPE	WIRING	DESTINATION	WIRING TYPE	WIRING	PANEL	CIRCUIT RATING	CIRCUIT WIRING		
STR-20												
PRESSURE REDUCING VALVE STATION												
20-PLC-1	PRV STATION PLC CONTROL PANEL							20-PDP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12	2605-401	1,4,5
FE-20-2-1	PRV STATION POTABLE WATER FLOW METER	FIT-20-2-1	MANUFACTURERS CABLE	M1							2690-100	2
FIT-20-2-1	PRV STATION POTABLE WATER FLOW TRANSMITTER	20-PLC-1	24VDC ANALOG SIGNAL	A2	20-PLC-1	24VDC PULSE SIGNAL	A1	20-PDP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12	2690-101	3
PIT-20-3-1	PRV STATION HPZ PRESSURE TRANSMITTER	20-PLC-1	24VDC ANALOG SIGNAL	A1							2690-301	1
PIT-20-3-2	PRV STATION LPZ PRESSURE TRANSMITTER	20-PLC-1	24VDC ANALOG SIGNAL	A1							2690-301	1
TSL-20-4-1	PRV STATION ENCLOSURE FREEZE STATE	20-PLC-1	24VDC DISCRETE SIGNAL	D2								1,8
STR-30												
NORTH BOOSTER STATION												
30-PLC-1	NORTH BOOSTER STATION PLC CONTROL PANEL							30-LP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12	2690-800	1,4,5
30-ATS-1	NORTH BOOSTER STATION AUTOMATIC TRANSFER SWITCH	30-PLC-1	24VDC DISCRETE SIGNAL	D10	LCP-30-8-1	24VDC DISCRETE SIGNAL	D2				2690-800	1
LCP-30-8-1	NORTH BOOSTER STATION STANDBY GENERATOR CONTROL PANEL	30-PLC-1	24VDC DISCRETE SIGNAL	D4							2632-301	1
LCP-30-8-2	NORTH BOOSTER STATION STANDBY GENERATOR REMOTE ANNUNCIATOR	LCP-30-8-1	MANUFACTURERS CABLE	M1							2690-900	1
XS-30-8-1	NORTH BOOSTER STATION STANDBY GENERATOR REMOTE E-STOP	LCP-30-8-1	24VDC DISCRETE SIGNAL	D2							2690-900	1
TIT-30-7-1	NORTH BOOSTER STATION TEMPERATURE TRANSMITTER	30-PLC-1	24VDC ANALOG SIGNAL	A1							2690-900	1
LSH-30-7-1	NORTH BOOSTER STATION ROOM FLOOD SWITCH	30-PLC-1	24VDC DISCRETE SIGNAL	D2							2690-080	1
ZS-30-6-1	NORTH BOOSTER STATION INTRUSION DOOR SWITCH	30-PLC-1	24VDC DISCRETE SIGNAL	D2							2690-601	1
TSH-30-1-3	NORTH BOOSTER STATION BOOSTER PUMP NO.3 MOTOR HIGH TEMPERATURE SWITCH	AFD-30-1-3	24VDC DISCRETE SIGNAL	D2								6
TSH-30-1-2	NORTH BOOSTER STATION BOOSTER PUMP NO.2 MOTOR HIGH TEMPERATURE SWITCH	AFD-30-1-2	24VDC DISCRETE SIGNAL	D2								2
TSH-30-1-1	NORTH BOOSTER STATION BOOSTER PUMP NO.1 MOTOR HIGH TEMPERATURE SWITCH	AFD-30-1-1	24VDC DISCRETE SIGNAL	D2								2
FE-30-3-1	NORTH BOOSTER STATION POTABLE WATER FLOW METER	FIT-30-3-1	MANUFACTURERS CABLE	M1							2690-100	2
FIT-30-3-1	NORTH BOOSTER STATION POTABLE WATER FLOW TRANSMITTER	30-PLC-1	24VDC ANALOG SIGNAL	A1	30-PLC-1	24VDC PULSE SIGNAL	A1	30-LP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12	2690-101	3
PIT-30-4-1	NORTH BOOSTER STATION LPZ PRESSURE TRANSMITTER	30-PLC-1	24VDC ANALOG SIGNAL	A1							2690-301	1
PIT-30-4-2	NORTH BOOSTER STATION HPZ PRESSURE TRANSMITTER	30-PLC-1	24VDC ANALOG SIGNAL	A1							2690-301	1
FS-30-2-1	NORTH BOOSTER STATION PRESSURE REDUCING VALVE FLOW SWITCH	30-PLC-1	24VDC DISCRETE SIGNAL	D2				30-LP-1	120 V - 20 A / 1 P	1-#12, 1-#12, 1-#12	2690-151	1
LT-30-5-1	NORTH BOOSTER STATION HYPOCHLORITE STORAGE TANK T-30-6-1 LEVEL SENSOR											6

PRV & BOOSTER STATION - PROCESS VALVE ELECTRICAL INSTALLATION AND WIRING SCHEDULE

TAG NUMBER	DESCRIPTION	FIRST SIGNAL/CONTROL HOMERUN			SECOND SIGNAL/CONTROL HOMERUN			POWER HOMERUN			DETAIL	NOTES
		DESTINATION	WIRING TYPE	WIRING	DESTINATION	WIRING TYPE	WIRING	PANEL	CIRCUIT RATING	CIRCUIT WIRING		
STR-20												
PRV STATION												
WCV-20-1-1	PRV STATION PRESSURE REDUCING VALVE	XVC-20-1-1	24VDC DISCRETE SIGNAL	D4	XVC-20-1-1	24VDC ANALOG SIGNAL	A1					2,4

ELECTRICAL INSTALLATION AND WIRING SCHEDULE

1. EQUIPMENT PROVIDED BY DIVISION 26.
2. EQUIPMENT FURNISHED AND INSTALLED UNDER ANOTHER DIVISION OF THE SPECIFICATIONS BUT WIRED UNDER DIVISION 26.
3. EQUIPMENT FURNISHED UNDER ANOTHER DIVISION OF THE SPECIFICATIONS BUT INSTALLED AND WIRED UNDER DIVISION 26.
4. REFER TO SCADA SYSTEM NETWORK ARCHITECTURE DRAWINGS FOR COMMUNICATION CABLING REQUIREMENTS.
5. REFER TO ONE-LINE DIAGRAM FOR POWER WIRING REQUIREMENTS.
6. FUTURE EQUIPMENT OR INSTRUMENTATION TO BE PROVIDED UNDER A FUTURE CONTRACT.
7. MINIMUM SIZE CONDUCTORS AND CONDUIT ARE IDENTIFIED IN THE SCHEDULE FOR THE MOTOR. CONTRACTOR SHALL PROVIDE SHIELDED DRIVE CABLE (THREE CONDUCTOR AND GROUND) FOR THE MOTOR AND SHALL ADJUST CONDUIT SIZE TO ACCOMMODATE THE CABLE. FOR BIDDING PURPOSES ASSUME CONDUIT SIZE WILL INCREASE ONE STANDARD TRADE SIZE.
8. MOUNT FROM BOTTOM OR FACE OF CONTROL PANEL. OTHERWISE FIELD COORDINATE LOCATION.

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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

WIRING SCHEDULES

PROJECT NO. 07985049.2
SHEET 99-E602

20-PLC-1, CONTROL PANEL PLC I/O SCHEDULE

RACK	SLOT	POINT	TYPE	DESCRIPTION	NOTES
01	00	00	N/A	TYPE I CONTROLLER	1
01	01	00	AI	PRV STATION POTABLE WATER FORWARD FLOW RATE	1
01	01	01	AI	PRV STATION LPZ PRESSURE	1
01	01	02	AI	PRV STATION HPZ PRESSURE	1
01	01	03	AI	PRV STATION PRESSURE RECUDING VALVE CONTROLLER	1
01	01	04	AI	PRV STATION POTABLE WATER BACKWARD FLOW RATE	1
01	01	05	AI	SPARE	1
01	01	06	AI	SPARE	1
01	01	07	AI	SPARE	1
01	02	00	AO	SPARE	1
01	02	01	AO	SPARE	1
01	02	02	AO	SPARE	1
01	02	03	AO	SPARE	1
01	03	00	DI	20-PLC-1 CONTROL POWER	1
01	03	01	DI	20-PLC-1 UPS FAULT	1
01	03	02	DI	PRV STATION ENCLOSURE LOW TEMPERATURE	1
01	03	03	DI	PRV STATION POTABLE WATER FLOW TOTAL	1
01	03	04	DI	SPARE	1
01	03	05	DI	SPARE	1
01	03	06	DI	SPARE	1
01	03	07	DI	SPARE	1
01	03	08	DI	SPARE	1
01	03	09	DI	SPARE	1
01	03	10	DI	SPARE	1
01	03	11	DI	SPARE	1
01	03	12	DI	SPARE	1
01	03	13	DI	SPARE	1
01	03	14	DI	SPARE	1
01	03	15	DI	SPARE	1
01	04	00	DO	20-PLC-1 SCAN DELAY	1
01	04	01	DO	SPARE	1
01	04	02	DO	SPARE	1
01	04	03	DO	SPARE	1
01	04	04	DO	SPARE	1
01	04	05	DO	SPARE	1
01	04	06	DO	SPARE	1
01	04	07	DO	SPARE	1
01	04	08	DO	SPARE	1
01	04	09	DO	SPARE	1
01	04	10	DO	SPARE	1
01	04	11	DO	SPARE	1
01	04	12	DO	SPARE	1
01	04	13	DO	SPARE	1
01	04	14	DO	SPARE	1
01	04	15	DO	SPARE	1

30-PLC-1, CONTROL PANEL PLC I/O SCHEDULE

RACK	SLOT	POINT	TYPE	DESCRIPTION	NOTES
01	00	00	N/A	TYPE I CONTROLLER	1
01	01	00	AI	NORTH BOOSTER STATION POTABLE WATER FORWARD FLOW RATE	1
01	01	01	AI	NORTH BOOSTER STATION LPZ PRESSURE	1
01	01	02	AI	NORTH BOOSTER STATION HPZ PRESSURE	1
01	01	03	AI	SPARE	1
01	01	04	AI	NORTH BOOSTER STATION ROOM TEMPERATURE	1
01	01	05	AI	NORTH BOOSTER STATION POTABLE WATER BACKWARD FLOW RATE	1
01	01	06	AI	SPARE	1
01	01	07	AI	SPARE	1
01	02	00	AI	HYPOCHLORITE CHEMICAL PUMP SPEED	2
01	02	01	AI	HYPOCHLORITE STORAGE TANK T-30-6-1 LEVEL	2
01	02	02	AI	SPARE	1
01	02	03	AI	SPARE	1
01	02	04	AI	SPARE	1
01	02	05	AI	SPARE	1
01	02	06	AI	SPARE	1
01	02	07	AI	SPARE	1
01	03	00	AO	HYPOCHLORITE CHEMICAL PUMP PACE	2
01	03	01	AO	SPARE	1
01	03	02	AO	SPARE	1
01	03	03	AO	SPARE	1
01	04	00	DI	30-PLC-1 CONTROL POWER	1
01	04	01	DI	30-PLC-1 UPS FAULT	1
01	04	02	DI	NORTH BOOSTER STATION POTABLE WATER FLOW TOTAL	1
01	04	03	DI	NORTH BOOSTER STATION INTRUSION ALARM	1
01	04	04	DI	NORTH BOOSTER STATION INTRUSION ALARM DISIENABLE	1
01	04	05	DI	NORTH BOOSTER STATION ROOM FLOOD ALARM	1
01	04	06	DI	HYPOCHLORITE CHEMICAL PUMP FAULT	2
01	04	07	DI	HYPOCHLORITE CHEMICAL PUMP RUN	2
01	04	08	DI	NORTH BOOSTER STATION LEVEL CONTROL IN WATER TOWER LEVEL	1
01	04	09	DI	NORTH BOOSTER STATION LEVEL CONTROL IN LOCAL PRESSURE	1
01	04	10	DI	NORTH BOOSTER STATION LEVEL CONTROL IN AUTO	1
01	04	11	DI	NORTH BOOSTER STATION PRESSURE REDUCING VALVE FLOW	1
01	04	12	DI	SPARE	1
01	04	13	DI	SPARE	1
01	04	14	DI	SPARE	1
01	04	15	DI	SPARE	1
01	05	00	DI	NORTH BOOSTER STATION UTILITY AVAILABLE	1
01	05	01	DI	NORTH BOOSTER STATION GENERATOR AVAILABLE	1
01	05	02	DI	NORTH BOOSTER STATION GENSET EXERCISE	1
01	05	03	DI	NORTH BOOSTER STATION ON UTILITY	1
01	05	04	DI	NORTH BOOSTER STATION ON GENERATOR	1
01	05	05	DI	NORTH BOOSTER STATION GENSET RUN	1
01	05	06	DI	NORTH BOOSTER STATION GENSET FAIL	1
01	05	07	DI	NORTH BOOSTER STATION GENSET REMOTE E-STOP ENGAGED	1
01	05	08	DI	NORTH BOOSTER STATION GENSET NOT IN AUTO	1
01	05	09	DI	SPARE	1
01	05	10	DI	SPARE	1
01	05	11	DI	SPARE	1
01	05	12	DI	SPARE	1
01	05	13	DI	SPARE	1
01	05	14	DI	SPARE	1
01	05	15	DI	SPARE	1
01	06	00	DO	30-PLC-1 SCAN DELAY	1
01	06	01	DO	NORTH BOOSTER STATION INTRUSION ALARM LIGHT ON/OFF	1
01	06	02	DO	HYPOCHLORITE CHEMICAL PUMP REQUIRED	2
01	06	03	DO	SPARE	1
01	06	04	DO	SPARE	1
01	06	05	DO	SPARE	1
01	06	06	DO	SPARE	1
01	06	07	DO	SPARE	1
01	06	08	DO	SPARE	1
01	06	09	DO	SPARE	1
01	06	10	DO	SPARE	1
01	06	11	DO	SPARE	1
01	06	12	DO	SPARE	1
01	06	13	DO	SPARE	1
01	06	14	DO	SPARE	1
01	06	15	DO	SPARE	1

AFD-30-1-1, ETHERNET I/O SCHEDULE

MCC COMPARTMENT	MODULE	POINT	TYPE	MODULE TYPE	DESCRIPTION	NOTES
N/A	01A	00	AI	AFD INTEGRAL I/O	SPARE	3
N/A	01A	01	AI	AFD INTEGRAL I/O	SPARE	3
N/A	01B	00	AO	AFD INTEGRAL I/O	SPARE	3
N/A	01B	01	AO	AFD INTEGRAL I/O	SPARE	3
N/A	01C	00	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 SCADA SYSTEM CONTROL AVAILABLE	3
N/A	01C	01	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 AFD START	3
N/A	01C	02	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 RESET	3
N/A	01C	03	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 HIGH MOTOR TEMPERATURE	3
N/A	01C	04	DI	AFD INTEGRAL I/O	SPARE	3
N/A	01C	05	DI	AFD INTEGRAL I/O	SPARE	3
N/A	01D	00	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 REQUIRED	3
N/A	01D	01	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 AFD RUN	3
N/A	01D	02	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.1 AFD FAIL	3

AFD-30-1-2, ETHERNET I/O SCHEDULE

MCC COMPARTMENT	MODULE	POINT	TYPE	MODULE TYPE	DESCRIPTION	NOTES
N/A	01A	00	AI	AFD INTEGRAL I/O	SPARE	3
N/A	01A	01	AI	AFD INTEGRAL I/O	SPARE	3
N/A	01B	00	AO	AFD INTEGRAL I/O	SPARE	3
N/A	01B	01	AO	AFD INTEGRAL I/O	SPARE	3
N/A	01C	00	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 SCADA SYSTEM CONTROL AVAILABLE	3
N/A	01C	01	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 AFD START	3
N/A	01C	02	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 RESET	3
N/A	01C	03	DI	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 HIGH MOTOR TEMPERATURE	3
N/A	01C	04	DI	AFD INTEGRAL I/O	SPARE	3
N/A	01C	05	DI	AFD INTEGRAL I/O	SPARE	3
N/A	01D	00	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 REQUIRED	3
N/A	01D	01	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 AFD RUN	3
N/A	01D	02	DO	AFD INTEGRAL I/O	BOOSTER PUMP NO.2 AFD FAIL	3

I/O SCHEDULE NOTES

1. I/O POINT PROVIDED, INSTALLED, AND CONFIGURED IN NEW PLC SYSTEM UNDER THIS CONTRACT.
2. I/O POINT PROVIDED, INSTALLED AND CONFIGURED IN NEW PLC SYSTEM UNDER THIS CONTRACT. I/O POINT RESERVED FOR FUTURE EQUIPMENT.
3. I/O POINT PROVIDED, INSTALLED, AND CONFIGURED IN NEW INTEGRAL AFD I/O UNDER THIS CONTRACT.

PLOT DATE: 11/18/2025 5:06:40 PM - Autodesk Docs://07985049 - New Richmond Water Tower #3 and Booster Station Design/07985049_ELECTRICAL MODEL_R24.rvt

PROJECT DATE: NOVEMBER 18, 2025
DRAWN BY: AMS
DESIGNED BY: AMS
CHECKED BY: LET

No	DATE	REVISIONS	BY

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1230 SOUTH BOULEVARD, BARABOO WI 53913
(608) 356-2771 www.msa-ps.com
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BOOSTER STATION AND PRV STATION
CITY OF NEW RICHMOND
ST. CROIX COUNTY, WISCONSIN

I/O SCHEDULES

PROJECT NO. 07985049.2
SHEET 99-E603