FINANCE DEPARTMENT
DIVISION OF PURCHASES & SUPPLIES

Sheldon A. Neeley, Mayor

PROPOSAL #23000514

DIGESTER PIPING FABRICATION PROJECT

Date Posted: 11/21/22

PROPOSAL NO. 23000514

CITY OF FLINT

FINANCE DEPARTMENT
DIVISION OF PURCHASES AND SUPPLIES

City Hall, 1101 S. Saginaw Street, Room #203 – Flint, Michigan 48502
(810) 766-7340 www.cityofflint.com

Sheldon Neeley
Mayor

REQUEST FOR PROPOSALS

OWNER/RETURN TO:

THE CITY OF FLINT
FINANCE DEPARTMENT – DIVISION OF PURCHASES AND SUPPLIES
1101 S. SAGINAW ST., ROOM 203, 2nd FLOOR
FLINT, MI 48502

PROPOSAL # 23000514

SCOPE OF WORK:

The City of Flint, Finance Department of Purchases & Supplies, is soliciting sealed bids for providing:

DIGESTER PIPING FABRICATION PROJECT

Per the attached additional requirements**.**

If your firm is interested in providing the requested services, please submit:

Submit to City:
1 original, printed, signed, original proposals and signed addenda
2 additional copies unbound
1 electronic copy

Proposal submittal information MUST be received by the following dates and times:

1. The mail in **HARD COPY** with the original signature (signed documents) must be received by **Thursday, December 8, 2022 by 11:00 A.M. (EST), City of Flint, Finance Department - Division of Purchases and Supplies, 1101 S. Saginaw St., Room 203, Flint, MI, 48502.** Bids must be in a sealed envelope clearly identifying the proposal name and proposal number.
2. **Electronic Copy**, please email to **PurchasingBids@cityofflint.com** ~~by~~ **Thursday, December 8, 2022 by 11:00 AM** (EST). Pease note that in the subject line of the email, type in the proposal name and number.
2. Faxed bids are not accepted.
3. Both mail in proposal and electronic submittal must be received by due date and time.

PLEASE NOTE: When dropping off a bid, please do not put bids in drop boxes on the outside of City Hall. Please call if you have any questions and need to drop off a bid.

All additional proposal documents, requirements, addendums, specifications, and plans/drawings (if utilized) are available on the Purchasing page of the City of Flint's web site at **https://www.cityofflint.com/finance/purchasing/bids-2/** under "open bids" and the specific bid or proposal number assigned to this notice.

Effective immediately upon release of these Bidding Documents, and until notice of contract award, all official communications from proposers regarding the requirements of this Bid shall be directed to:

Lauren Rowley
810-766-7340
lrowley@cityofflint.com

The City, or designee, shall distribute all official changes, modifications, responses to questions or notices relating to the requirements of this Bid. Addendum to this Bid may be developed and shared with all Vendors. Any other information of any kind from any other source shall not be considered official, and proposers relying on other information do so at their own risk.

NOTICE TO VENDOR Offers, subject to the conditions made a part hereof, will be received at this office, ***1101 S. Saginaw St., Flint, MI 48502 for the following:***

All additional proposal documents, requirements, addendums, specifications, and plans/drawings (if utilized) are available on the Purchasing page of the City of Flint's web site at **https://www.cityofflint.com/finance/purchasing/bids-2/** under "open bids" and the specific bid or proposal number assigned to this notice.

New vendors should complete and submit a vendor application, IRS W-9 Form, and Vendor ACH Payment Authorization Form with the City of Flint. Links to these forms are available at **https://www.cityofflint.com/finance/accounts-payable-department/.**

Results may be viewed next business day online EXCEPT when a bid is under review. The bidders/public will only see the names of the bidders that submitted a bid, not their cost. This will protect the bidders cost in case there is a re-bid.
https://www.cityofflint.com/finance/purchasing/results/ under "bid results".

City of Flint has partnered with BidNet as part of the MITN Purchasing Group (branded page link) to post bid opportunities to this site. As a vendor, you can register with the MITN Purchasing Group and be sure that you see all available bids and opportunities. By selecting automatic bid notification, your company will receive emails once the City of Flint has a bid opportunity that matches your company's business. In addition, the site handles bid opportunities, RFPs, and RFQs for other member governmental agencies throughout Michigan. City of Flint looks forward to providing you with more bid information and simplifying the entire bid, proposal, and quote processes for everyone involved. We appreciate your cooperation and welcome your participation. If you need help registering, please call the MITN Purchasing Group support department toll free 1-800-835-4603 option #2.

Link to City of Flint open solicitations:
MITN Purchasing Group (branded page link)

Any written questions regarding this project shall be directed to Lauren Rowley, Purchasing Manager at **lrowley@cityofflint.com** using the subject title of **"RFP #23-514 – DIGESTER PIPING FABRICATION PROJECT." Questions must be submitted by Friday, December 2, 2022 before 10:00 A.M. (EST). Please see attached form for Question submittal form.**

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Bid Opening Due Date – Thursday, December 8, 2022 at 11:00 A.M.
Bid Opening via Google Meet. The public is invited to view the opening by joining the Google Meet link below:

Join with Google Meet
Meeting ID
meet.google.com/xxp-byvy-fne
Phone Numbers
(US) +1 925-420-0069
PIN: 301 467 419#

- -

Mandatory Pre-Bid Meeting

A mandatory pre-bid meeting touring the Water Pollution Control Facility at the City of Flint will be held on **Wednesday, November 30, 2022 at 10:30 am EST at the City of Flint Water Pollution Control Facility, 4652 Beecher Rd, Flint, MI 48532**. Prospective bidders are to meet here, with a department official escorting individuals to tour the facility. This will be the only venue that potential contractors will be able to have a face-to-face conversation with the WPC Department. This venue will also allow contractors to ask any questions concerning this Project. Failure to attend this meeting may result in disqualification of your bid.

Interested bidders must submit a notice of intent in writing to attend the pre-bid meeting to John Florshinger, WPC Manager at jflorshinger@cityofflint.com by Monday, November 28, 2022 at 3:00 P.M.

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IN PERSON

The public is invited to view the bid opening in person by attending at McKenzie Conference Room, 2nd Floor, 1101 S. Saginaw St., Flint, MI 48502.

If you have any problems signing in, please email purchasingbids@cityofflint.com.

Sincerely,

Lauren Rowley

Lauren Rowley
Purchasing Manager

INSTRUCTIONS TO VENDORS

1) **PRE-BID INFORMATION AND QUESTIONS:** Each bid that is timely received will be evaluated on its merit and completeness of all requested information. In preparing bids, Bidders are advised to rely only upon the contents of this Request for Proposals (RFP) and accompanying documents and any written clarifications or addenda issued by the City of Flint. If a Bidder finds a discrepancy, error or omission in the RFP package, or requires any written addendum thereto, the Bidder is requested to notify the Purchasing contact noted on the cover of this RFP, so that written clarification may be sent to all prospective Bidders. **THE CITY OF FLINT IS NOT RESPONSIBLE FOR ANY ORAL INSTRUCTIONS**. All questions must be submitted in writing to the Finance Department of Purchases and Supplies before any pre-bid deadline (if specified) or at least one (1) week prior to the proposal opening date indicated on the front of this document.

2) **RFP MODIFICATIONS:** The City of Flint has the right to correct, modify or cancel the RFP, in whole or in part, or to reject any Bid, in whole or in part, within the discretion of the City of Flint, or their designee. If any such changes are made, all known recipients of the RFP will be sent a copy of such changes. If any changes are made to this RFP document by any party other than the City of Flint, the original document in the City of Flint's files takes precedence.

3) **PROPOSAL SUBMISSION:**

   a) The Bidder must include the following items, or the proposal may be deemed non-responsive:

      i) All forms contained in this RFP, fully completed.

   b) Bids must be submitted to the Finance Department of Purchases and Supplies, City of Flint, 1101 S. Saginaw Street, Room 203, Flint, Michigan 48502 by the date and time indicated as the deadline**.** The Purchasing Department time stamp will determine the official receipt time. It is each Bidder's responsibility to insure that their proposal is time stamped by the Purchasing Department by the deadline. This responsibility rests entirely with the Bidder, regardless of delays resulting from postal handling or for any other reasons. Proposals will be accepted at any time during the normal course of business only, said hours being 8:00 a.m. to 5:00 p.m. local time, Monday through Friday, legal holidays as exception.

   c) Bids must be enclosed in a sealed, non-transparent envelope, box or package, and clearly marked on the outside with the following: RFP Title, RFP Number, Deadline and Bidder's name.

   d) Submission of a bid establishes a conclusive presumption that the Bidder is thoroughly familiar with the Request for Proposals (RFP), and that the Contractor understands and agrees to abide by each and all of the stipulations and requirements contained therein.

   e) All prices and notations must be typed or printed in ink. No erasures are permitted. Mistakes may be crossed out and corrections must be initialed in ink by the person(s) signing the bid.

   f) Proposals sent by email, facsimile, or other electronic means will not be considered unless specifically authorized in this RFP.

   g) All costs incurred in the preparation and presentation of the bid are the Bidder's sole responsibility; no pre-bid costs will be reimbursed to any Bidder. All documentation submitted with the proposal will become the property of the City of Flint.

h) Proposals must be held firm for a minimum of 120 days.

4) **EXCEPTIONS:** Bidder shall clearly identify any proposed deviations from the Terms or Scope in the Request for Proposals. Each exception must be clearly defined and referenced to the proper paragraph in this RFP. The exception shall include, at a minimum, the proposed substitute language and opinion as to why the suggested substitution will provide equivalent or better service and performance. If no exceptions are noted in the bid, the City of Flint will assume complete conformance with this specification and the successful Bidder will be required to perform accordingly. Bids not meeting all requirements may be rejected.

5) **DUPLICATE BIDS:** No more than one (1) bid from any Bidder including its subsidiaries, affiliated companies and franchises will be considered by the City of Flint. In the event multiple proposals are submitted in violation of this provision, the City will have the right to determine which bid will be considered or, at its sole option, reject all such multiple proposals.

6) **WITHDRAWAL:** Bids may only be withdrawn by written notice prior to the date and time set for the opening of bids. No bid may be withdrawn after the deadline for submission.

7) **REJECTION/GOOD STANDING:** The City of Flint reserves the right to reject any or all bids, or to accept or reject any bid in part, and to waive any minor informality or irregularity in bids received if it is determined by the City of Flint, or their designee, that the best interest of the City will be served by doing so. No bid will be considered from any person, firm or corporation in arrears or in default to the City on any contract, debt, taxes or other obligation, or if the Bidder is debarred by the City of Flint from consideration for a contract award pursuant to Section 18-21.5 (d) of Article IV of the "Purchasing Ordinance of the City of Flint".

8) **PROCUREMENT POLICY:** Procurement for the City of Flint will be handled in a manner providing fair opportunity to all businesses. This will be accomplished without abrogation or sacrifice of quality and as determined to be in the best interest of the City. The City of Flint and their officials have the vested authority to execute a contract, subject to City Council and Mayoral approval where required.

9) **BID SIGNATURES:** Bids must be signed by an authorized official of the Bidder. Each signature represents binding commitment upon the Bidder to provide the goods and/or services offered to the City of Flint if the Bidder is determined to be the lowest Responsive and Responsible Bidder.

10) **CONTRACT AWARD/SPLIT AWARDS:** The City of Flint reserves the right to award by item and/or group of items. The Bidder to whom the award is made will be notified at the earliest possible date. Tentative acceptance of the bid, intent to recommend award of a contract and actual award of the contract will be provided by written notice sent to the Bidder at the address designated in the bid if a separate Agreement is required to be executed. After a final award of the Agreement by the City of Flint, the Contractor/Vendor must execute and perform said Agreement. All proposals must be firm for at least 120 days from the due date of the proposal. If, for any reason, a contract is not executed with the selected Bidder within 14 days after notice of recommendation for award, then the City may recommend the next lowest responsive and responsible Bidder.

11) **NO RFP RESPONSE:** Bidders who receive this RFP but who do not submit a bid should return this RFP package stating "No Bid" and are encouraged to list the reason(s) for not responding. Failure to return this form may result in removal of the Bidder's name from all future lists.

12) **FREEDOM OF INFORMATION ACT (FOIA) REQUIREMENTS:** Bids are subject to public disclosure after the deadline for submission in accordance with state law.

13) **ARBITRATION:** Contractor/Vendor agrees to submit to arbitration all claims, counterclaims, disputes and other matters in question arising out of or relating to this agreement or the breach thereof. The Contractor's/Vendor's agreement to arbitrate shall be specifically enforceable under the prevailing law of any court having jurisdiction to hear such matters. Contractor's/Vendor's obligation to submit to arbitration shall be subject to the following provisions:

    a) Notice of demand for arbitration must be submitted to the City in writing within a reasonable time after the claim, dispute or other matter in question has arisen. A reasonable time is hereby determined to be fourteen (14) days from the date the party demanding the arbitration knows or should have known the facts giving rise to their claim, dispute or question. In no event may the demand for arbitration be made after the time when institution of legal or equitable proceedings based on such claim dispute or other matters in question would be barred by the applicable statute of limitation.

    b) Within fourteen (14) days from the date that demand for arbitration is received by the City, each party shall submit to the other the name of one person to serve as an arbitrator. The two arbitrators together shall then select a third person, the three together shall then serve as a panel in all proceedings. Any decision concurred in by a majority of the three shall be a final binding decision.

    c) The final decision rendered by said arbitrators shall be binding and conclusive and shall be subject to specific enforcement by a court of competent jurisdiction.

    d) The costs of the arbitration shall be split and borne equally between the parties and such costs are not subject to shifting by the arbitrator.

    e) This provision shall survive the expiration or termination of this Agreement in perpetuity.

14) **BID HOLD:** The City of Flint may hold bids for a period of one hundred twenty (120) days from opening, for the purpose of reviewing the results and investigating the qualifications of bidders prior to making an award.

15) **NONCOMPLIANCE:** Failure to deliver in accordance with specifications will be cause for the City of Flint and they may cancel the contract or any part thereof and purchase on the open market, charging any additional cost to the Contractor/Vendor.

16) **DISCLAIMER OF CONTRACTUAL RELATIONSHIP:** Nothing contained in these documents shall create any contractual relationship between the City and any Subcontractor or Sub-subcontractor.

17) **ERRORS AND OMISSIONS:** Bidder is not permitted to take advantage of any obvious errors or omissions in specifications**.**

18) **INTERPRETATION:** In the event that any provision contained herein shall be determined by a court of competent jurisdiction or an appropriate administrative tribunal to be contrary to the provision of law or to be unenforceable for any reason, then, to the extent necessary and possible to render the remainder of this Agreement enforceable, such provision may be modified or severed by such court or administrative tribunal having jurisdiction over this Agreement and the interpretation thereof, or the parties hereto, so as to, as nearly as possible, carry out the intention of the parties hereto, considering the purpose of the entire Agreement in relation to such provision.

19) **LAWS AND ORDINANCES:** The Bidder shall obey and abide by all of the laws, rules and regulations of the Federal Government, State of Michigan, Genesee County and the City of Flint, applicable to the performance of this Agreement, including, but not limited to, labor laws, and laws regulating or applying to public improvement, local government, and its operational requirements.

20) **LOCAL PREFERENCE:** Contractors/bidders located within the corporate city limits of Flint, Michigan may be given a seven percent (7%) competitive price advantage. Additionally, if the lowest responsible bidder is not located within the limits of the City of Flint, but is located within the County of Genesee, and said bidder does not exceed the bid of the lowest non-local bidder by more than three and one-half percent (3-1/2%), then said lowest Genesee County bidder may be determined to be the lowest responsible bidder, and make the award to such Genesee County bidder accordingly, subject to the approval of the City Council. If the lowest non-local bidder does not exceed that of any Proposers/bidders by (7%) inside the City of Flint or (3-1/2%) inside the County of Genesee, then the Purchasing Director shall be allowed to request that the lowest local vendor match the price offered by the lowest non-local vendor.

21) **MATERIAL WORKMANSHIP AND STANDARDS OF PERFORMANCE:** The Bidder agrees to exercise independent judgment and to complete performance under this Agreement in accordance with sound professional practices. In entering into this Agreement, the City is relying upon the professional reputation, experience, certification and ability of the Bidder by her/him/themselves or by others employed by her/him/them and working under their direction and control. The continued effectiveness of this Agreement during its term or any renewal term shall be contingent, in part, upon the Bidder maintaining her/his/their operating qualifications in accordance with the requirements of federal, state and local laws. All materials furnished must be new, of latest model and standard first grade quality, or best workmanship and design, unless otherwise expressly specified. Bidder, if required, must furnish satisfactory evidence of quality materials; offers of experimental or unproven equipment may be disregarded.

22) **MODIFICATIONS/CHANGES:** Any modification to this agreement must be in writing and signed by the authorized employee, officer, board or council representative authorized to make such modifications pursuant to the State law and local ordinances.

23) **NON-COLLUSION:** The Bidder acknowledges that by signing this document that she/he/they is/are duly authorized to make said offer on behalf of the company she/he/they represent(s) and that said bid is

genuine and not sham or collusive and not made in the interests or on behalf of any person not therein named, and that she/he/they and said bidder have not directly induced or solicited any other person(s) or corporation to refrain from responding to this solicitation and that she/he/they and said bidder have not in any manner sought by collusion to secure to themselves and said bidder any advantage over any other bidder.

24) **NON-DISCRIMINATION:** Pursuant to the requirements of 1976 P.A. 453 (Michigan Civil Rights Act) and 1976 P.A. 220 (Michigan Handicapped Rights Act), the local unit and its agent agree not to discriminate against any employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment or a matter directly or indirectly related to employment because of race, color, religion, national origin, age, sex, height, weight, marital status or because of a handicap that is unrelated to the person's ability to perform the duties of nondiscrimination provision identical to this provision and binding upon any and all contractors and subcontractors. A breach of this covenant shall be regarded as a material breach of this contract.

25) **SUBCONTRACTING:** No subcontract work shall be started prior to the written approval of the subcontractor by the City. The City reserves the right to accept or reject any subcontractor.

26) **UNION COMPLIANCE:** Bidder agrees to comply with all regulations and requirements of any national or local union(s) that may have jurisdiction over any of the materials, facilities, services or personnel to be furnished by the City.

27) **WAIVER:** Failure of the City to insist upon strict compliance with any of the terms, covenants or conditions of this Agreement shall not be deemed a waiver of that term, covenant or condition or of any other term, covenant or condition. Any waiver or relinquishment of any right or power hereunder at any one or more times shall not be deemed a waiver or relinquishment of that right or power at any other time.

28) **CITY INCOME TAX WITHHOLDING:** Contractor and any subcontractor engaged in this contract shall withhold from each payment to his employees the City income tax on all of their compensation subject to tax, after giving effect to exemptions, as follows:

a) Residents of the City:
At a rate equal to 1% of all compensation paid to the employee who is a resident of the City of Flint.

b) Non-residents:
At a rate equal to 1/2% of the compensation paid to the employee for work done or services performed in the City of Flint.

These taxes shall be held in trust and paid over to the City of Flint in accordance with City ordinances and State law. Any failure to do so shall constitute a substantial and material breach of this contract.

29) **CONTRACT DOCUMENTS:** The invitation for proposal, instructions to proposal, proposal, affidavit, addenda (if any), statement of Bidder's qualifications (when required), general conditions, special conditions, performance bond, labor and material payment bond, insurance certificates, technical specifications, and drawings, together with this agreement, form the contract, and they are as fully

a part of the contract as if attached hereto or repeated herein.

30) **DISCLAIMER OF CONTRACTUAL RELATIONSHIP WITH SUBCONTRACTORS:** Nothing contained in the Contract Documents shall create any contractual relationship between the City and any Subcontractor or Sub-subcontractor.

31) **EFFECTIVE DATE:** Any agreement between the City and the Bidder shall be effective upon the date that it is executed by all parties hereto.

32) **FORCE MAJURE:** Neither party shall be responsible for damages or delays caused by Force Majeure nor other events beyond the control of the other party and which could not reasonably have anticipated the control of the other party and which could not reasonably have been anticipated or prevented. For purposes of this Agreement, Force Majeure includes, but is not limited to, adverse weather conditions, floods, epidemics, war, riot, strikes, lockouts, and other industrial disturbances; unknown site conditions, accidents, sabotage, fire, and acts of God. Should Force Majeure occur, the parties shall mutually agree on the terms and conditions upon which the services may continue.

33) **INDEMNIFICATION:** To the fullest extent permitted by law, Bidder agrees to defend, pay on behalf of, indemnify, and hold harmless the City of Flint, its elected and appointed officials, employees and volunteers and others working on behalf of the City of Flint, including the Project Manager, against any and all claims, demands, suits, or losses, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the City of Flint, its elected and appointed officials, employees, volunteers or others working on behalf of the City of Flint, by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, which may arise as a result of Bidder's acts, omissions, faults, and negligence or that of any of his employees, agents, and representatives in connection with the performance of this contract. Should the Bidder fail to indemnify the City in the above-mentioned circumstances, the City may exercise its option to deduct the cost that it incurs from the contract price forthwith.

These provisions shall survive the termination or expiration of any agreement entered into as a result of this request.

34) **INDEPENDENT CONTRACTOR:** No provision of this contract shall be construed as creating an employer-employee relationship. It is hereby expressly understood and agreed that Bidder is an "independent contractor" as that phrase has been defined and interpreted by the courts of the State of Michigan and, as such, Bidder is not entitled to any benefits not otherwise specified herein.

35) **NO THIRD-PARTY BENEFICIARY:** No contractor, subcontractor, mechanic, material man, laborer, vendor, or other person dealing with the principal Contractor shall be, nor shall any of them be deemed to be, third-party beneficiaries of this contract, but each such person shall be deemed to have agreed (a) that they shall look to the principal Contractor as their sole source of recovery if not paid, and (b) except as otherwise agreed to by the principal Contractor and any such person in writing, they may not enter any claim or bring any such action against the City under any circumstances. Except as provided by law, or as otherwise agreed to in writing between the City and such person, each such person shall be deemed to have waived in writing all rights to seek redress from the City under any circumstances whatsoever.

36) **NON-ASSIGNABILITY:** Contractor shall not assign or transfer any interest in this contract without the prior written consent of the City provided, however, that claims for money due or to become due to Contractor from the City under this contract may be assigned to a bank, trust company, or other financial institution without such approval. Notice of any such assignment or transfer shall be furnished promptly to the City.

37) **NON-DISCLOSURE/CONFIDENTIALITY:** Contractor agrees that the documents identified herein as the contract documents are confidential information intended for the sole use of the City and that Contractor will not disclose any such information, or in any other way make such documents public, without the express written approval of the City or the order of the court of appropriate jurisdiction or as required by the laws of the State of Michigan.

38) **RECORDS PROPERTY OF CITY:** All documents, information, reports and the like prepared or generated by Contractor as a result of this contract shall become the sole property of the City of Flint.

39) **SEVERABILITY:** In the event that any provision contained herein shall be determined by a court or administrative tribunal to be contrary to a provision of state or federal law or to be unenforceable for any reason, then, to the extent necessary and possible to render the remainder of this Agreement enforceable, such provision may be modified or severed by such court or administrative tribunal so as to, as nearly as possible, carry out the intention of the parties hereto, considering the purpose of the entire Agreement in relation to such provision. The invalidation of one or more terms of this contract shall not affect the validity of the remaining terms.

40) **TERMINATION:** This contract may be terminated by either party hereto by submitting a notice of termination to the other party. Such notice shall be in writing and shall be effective 30 days from the date it is submitted unless otherwise agreed to by the parties hereto. Contractor, upon receiving such notice and prorated payment upon termination of this contract shall give to the City all pertinent

records, data, and information created up to the date of termination to which the City, under the terms of this contract, is entitled.

41) **TIME PERFORMANCE:** Contractor's services shall commence immediately upon receipt of the notice to proceed and shall be carried out forthwith and without reasonable delay.

42) **EVALUATION OF PROPOSAL:** In the City's evaluation of proposals, at minimum: cost, serviceability, financial stability, and all requirements set forth in this document shall be considered as selection and award criteria unless otherwise specified.

43) **PREVAILING WAGE:** When applicable, all work for this project, including that of any subcontractor or sub-subcontractor, must meet Davis-Bacon Act requirements and full prevailing wage. Information on Davis-Bacon reporting and requirements, including payroll reporting, can be found at: **https://www.dol.gov/whd/govcontracts/dbra.htm**

44) **INSURANCE & BONDS:** The bidder whose proposal is accepted will be required to furnish bonds and evidence of insurance within five days from date of Notice of Award. In case of failure or refusal on the part of the bidder to furnish bonds, if required, within the set period, the amount of deposit may be forfeited to the county and the contract may be awarded to the next lowest responsible bidder. Upon the notification of award and approval of the bond, the deposit will be returned to the proposer. The deposit of persons other than the one to whom and award is made will be returned to the person or persons making the proposal immediately after the contract and bonds have been executed.

45) **PROPOSAL SUBMISSION:** Proposals and all information requested of the vendor shall be entered in the appropriate spaces. Failure to do so may disqualify the vendor's offer. An authorized officer or employee of the bidder shall submit the proposal.

46) **PRICES:** Prices proposed shall be for new products in current production unless otherwise specified. Where refurbished or discontinued items are offered they must be clearly identified as such. Prices proposed shall be exclusive of any rebates due the City. Any rebates the City may be entitled to should be shown as a separate line item and include expiration date.
Corrections and/or modifications received after the bid closing time specified will not be accepted. Unit prices prevail.
All prices will be bid F.O.B. DESTINATION, INCLUDE ALL DELIVERY AND ANY ADDITIONAL CHARGES, and remain in effect as specified in the quotation.

47) **AWARD:** Unless otherwise stated in the proposal documents, the City cannot guarantee exclusivity of the contract for the proposed products or services.
Award of the proposal shall be based upon a combination of factors, including but not limited to, adherence to proposal requirements, references and any other factors that may be in the City's best interest.
The City reserves the right to reject any and all bids, and to waive any defect or irregularity in bids. The City reserves the right to accept and separate items in the bid;
and to accept the proposal that in the opinion of the City is to the best advantage and interest

of the public we serve. The City also has the right to re-solicit bids if it is deemed to be in the best interest of the City.

The City reserves the right to reject low bids which have major deviations from our specification; to accept a higher quotation which has only minor deviations. By signing the bid, the vendor agrees to accept a split award unless the awarded vendor clearly indicates that it takes exception. The bid will be awarded to that responsible, responsive bidder whose proposal conforms to this solicitation, and will be most advantageous to the City, with regard not only to price, but also to availability of product, location and quality of product considered.

The City reserves the right to award all line items, to make no award or to award on an individual line item basis, whichever is deemed to be in the best interest of the City.

Time of delivery may be a consideration in the award.

48) **ETHICS IN PURCHASING:** Bidders and proposers are required to comply with Flint City Ordinance 3865 in its entirety. It is incumbent upon and the responsibility of the bidder to become familiar with and comply with the Purchasing ordinances as outlined in 3865 covering chapter 18 of the Flint City Ordinances. Bidder/Proposer acknowledges in accordance with Flint City Ordinance Section 18-21.19 Ethics in Purchasing, any and all communication about the bid selection process should be directed to those City employees delegated with the authority with respect to all purchases of goods and services.

Bidder/Proposer acknowledges and agrees that while a procurement is pending, bidders and proposers shall not communicate about the solicitation with any City employee, agent, or elected official, other than the purchasing director or other City personnel identify in the solicitation. This means that bidder and proposer are prohibited from communicating orally or by written communications, including but not limited to voicemail messages, social media, email, in person, among any other form of communication while the award is pending, to the aforementioned, with the exception to those employees designated by the City. If you are unclear about the process, it is your duty and obligation to contact the designated employee(s) for clarification.

Violations of the ethics provision of the ordinance, without regard to if the violation rises to the level of a criminal violation, may subject the bidder or proposer to debarment.

49) **BID PROTESTS:** If Bidder/Proposal believe that they are aggrieved in connection with the solicitation or award of the purchase order or contract, they may protest the action to the City as outlined in Flint City Charter Section 18-21.15.

PROPOSAL NO.23000514
DIGESTER PIPING FABRICATION PROJECT

THE FOLLOWING PAGES MUST BE COMPLETED AND INCLUDED WITH SUBMITTAL IN THE FOLLOWING ORDER.

Purchasing Checklist:

☐ Cover Sheet

☐ Exhibit A - Complete Proposal Submittal with detailed Summary of Pricing

☐ Exhibit B –Qualifications and Licenses Requirements

☐ Exhibit C – Disclosure of Supplier Responsibility Statement

☐ Exhibit D - List of References

☐ Exhibit E - Certificate of Insurance

☐ Exhibit F – Non-Bidder's Response

☐ City of Flint, Michigan Affidavit

❖ EXHIBIT A - SUBMITTAL WITH DETAILED SUMMARY OF PRICING

PROPOSAL NO.23000514
DIGESTER PIPING FABRICATION PROJECT

***PLEASE REFER TO PAGE .. FOR THE FULL SCOPE OF WORK.

1. Failure to use this bid form shall result in bid disqualification.
2. Failure to bid on all items shall result in an "incomplete bid" determination.
3. List value-added considerations on a separate sheet of paper.
4. All bid pricing to include shipping and freight charges.

THIS PAGE MUST BE COMPLETED AND INCLUDED WITH THE BID

The undersigned hereby certifies, on behalf of the respondent named in this Certification (the "Respondent"), that the information provided in this offer submitted to the City of Flint, Department of Purchase and Supplies is accurate and complete, and that I am duly authorized to submit same. I hereby certify that the Respondent has reviewed all documents and requirements included in this offer and accept its terms and conditions.

Terms: _____ Fed. ID #: _____

Company (Respondent): _____

Address: _____

_____

City, State & Zip Code: _____

Phone / Fax Number: _____ FAX: _____

Email: _____

Print Name and Title: _____
(Authorized Representative)

Signed: _____
(Authorized Representative)

❖ EXHIBIT B - QUALIFICATIONS AND LICENSES REQUIREMENTS

Please give a synopsis of your qualifications and experience with this service:

Please list Licenses:

How long have you been in business?

Have you done business with the City of Flint?

If yes, please state the project name.

❖ EXHIBIT C – DISCLOSURE OF SUPPLIER RESPONSIBILITY STATEMENT

1. List any convictions of any person, subsidiary, or affiliate of the company, arising out of obtaining, or attempting to obtain a public or private contract, or subcontract, or in the performance of such contract or subcontract.

2. List any convictions of any person, subsidiary, or affiliate of this company for offenses such as embezzlement, theft, fraudulent schemes, etc. or any other offense indicating a lack of business integrity or business honesty which affect the responsibility of the contractor.

3. List any convictions or civil judgments under state or federal antitrust statutes.

4. List any violations of contract provisions such as knowingly (without good cause) to perform, or unsatisfactory performance, in accordance with the specifications of a contract.

5. List any prior suspensions or debarments by any government agency.

6. List any contracts not completed on time.

7. List any documented violations of federal or state labor laws, regulations or standards, or occupational safety and health rules.

❖ EXHIBIT D – LIST OF REFERENCES: (3) SIMILAR SCOPE OF WORK FROM THE LAST 5 YEARS

Providing the following contact information enables the City of Flint to contact those accounts as references.

Reference #1:

Company/Municipality: _____

Contact Person: _____ Title: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ Fax: _____

Email: _____

Type of Project: _____

_____

Project Timeline (Dates): _____ Budget: _____

Reference #2:

Company/Municipality: _____

Contact Person: _____ Title: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ Fax: _____

Email: _____

Type of Project: _____

_____

Project Timeline (Dates): _____ Budget: _____

❖ EXHIBIT D – LIST OF REFERENCES: (3) SIMILAR SCOPE OF WORK FROM THE LAST 5 YEARS (CONTINUES)

Reference #3:

Company/Municipality: _____

Contact Person: _____ Title: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ Fax: _____

Email: _____

Type of Project: _____

_____

Project Timeline (Dates): _____ Budget: _____

❖ EXHIBIT E – CERTIFICATE OF INSURANCE

INSURANCE REQUIREMENTS

The Contractor shall notify all insurance agents and companies retained by the Contractor that these insurance requirements shall be included in any Agreement between the Contractor and the City of Flint.

The Contractor shall purchase and maintain, at its sole expense and as long as it is providing services to the City, the following insurance coverage:

Commercial General Liability - Occurrence form, including coverage for bodily injury, personal injury, property damage (broad form), premises/operations, blanket contractual, and products/completed operations. Coverage shall be endorsed to include the City as an additional insured for work performed by the Contractor in accordance with the Agreement.

Minimum Limits:

- $1,000,000 per occurrence/$2,000,000 general aggregate
- $2,000,000 aggregate for products and completed operations
- $1,000,000 personal and advertising injury

Automobile - Michigan "no-fault" coverage, and residual automobile liability, comprehensive form, covering owned, hired, and non-owned automobiles. Coverage shall be endorsed to include the City as an additional insured for work performed by the Contractor in accordance with the Agreement.

Minimum Limits:

- No-fault coverages - statutory
- $500,000 per person/$1,000,000 per accident - bodily injury
- $500,000 per occurrence - property damage
- A combined single limit of $1,000,000 per occurrence

Workers' Compensation and Employer's Liability- Statutory coverage or proof acceptable to the City of approval as a self-insurer by the State of Michigan.

❖ EXHIBIT E – CERTIFICATE OF INSURANCE (CONTINUES)

Minimum Limits:

- Workers' Compensation - statutory
- Employer's Liability - $100,000 each accident/$100,000 disease - each employee
- $500,000 disease - policy limit

Professional Liability – Covering acts, errors or omissions of a professional nature committed or alleged to have been committed by the Contractor or any of its subcontractors. Coverage shall be effective upon the date of the Agreement and shall remain effective for a period of three (3) years after the date of final payment thereunder. Such coverage shall be endorsed to include any subcontractors hired by the City.

Minimum Limits:

- $1,000,000 per occurrence, $1,000,000 annual aggregate

Insurance coverage shall cover all claims against the City of Flint, its officials and employees, arising out of the work performed by the Contractor or any subcontractors under the Agreement. Should any work be subcontracted, it shall be the responsibility of the Contractor to maintain Independent Contractor's Protective Liability Insurance with limits equal to those specified above for Commercial General Liability Insurance. In addition, the Contractor shall provide proof of Workers' Compensation Insurance for all subcontractors in compliance with the required statutory limits of the State of Michigan.

Said policies of insurance shall be with companies licensed to do business in the State of Michigan and in a form satisfactory to the City. All insurance companies must maintain a rating of B+, VIII or better from AM. Best Company. Certificates of insurance with a thirty-(30) day cancellation clause shall be filed with and approved by the City at least five (5) days in advance of commencing work under the Agreement. Cancellation, material restriction, non-renewal or lapse of any of the required policies shall be grounds for immediate termination of the Agreement by the City.

The City reserves the right to request a complete certified copy of the policies for the above coverage's.

Any reduction or exhaustion in the limits of required insurance coverage shall not be deemed to limit the indemnification afforded in accordance with the Agreement or any amendments thereto.

Depending on the subject matter of the transaction, the City may require other insurance coverage in addition to the coverage's contained herein.

THE BID NUMBER IS TO APPEAR ON ALL INSURANCE CERTIFICATES

❖ EXHIBIT F – NON-BIDDER'S RESPONSE

VENDOR'S NAME: _____

NON-BIDDER'S RESPONSE

For the purpose of facilitating your firm's response to our invitation to bid, the City of Flint is interested in ascertaining reasons for prospective bidder's failure to respond to "Invitations to Bid". If your firm is not responding to this bid, please indicate the reason(s) by checking any appropriate item(s) below and return this form to the above address.

We are ***not*** responding to this "Invitation to Bid" for the following reason(s):

_____ Items or materials requested not manufactured by us or not available to our company.

_____ Our items and/or materials do not meet specifications.

_____ Specifications not clearly understood or applicable (too vague, too rigid, etc.).

_____ Quantities too Small.

_____ Insufficient time allowed for preparation of bid.

_____ Incorrect address used. Our correct mailing address is:

_____

_____ Our branch / division handles this type of bid. We have forwarded this bid on to them but for the future the correct name and mailing address is: _____

_____ **OTHER:** _____

_____

Thank you for your participation in this bid.

AFFIDAVIT FOR INDIVIDUAL

STATE OF _____

S.S.

COUNTY OF _____

_____being duly sworn, deposes and says that they are the person making the above bid; and that said bid is genuine and not sham or collusive, and is not made in the interest of or on behalf of any person not therein named, and that they have not directly or indirectly induced or solicited any bidder to put in a sham bid; that they have not directly or indirectly induced or solicited any other person or corporation to refrain from bidding, and that they have not in any manner sought by collusion to secure themselves any advantage over other bidders.

Subscribed and sworn to before me at _____, in said County and State,

this _____day of _____, A.D. 20_____,

_____

*Notary Public, _____County,_____

My Commission expires_____,20_____

FOR CORPORATION

STATE OF _____

S.S.

COUNTY OF _____

_____being duly sworn, deposes and says that she/he/they

is_____of_____

(Official Title) (Name of Corporation)

a corporation duly organized and doing business under the laws of the State of _____ the corporation making the within and foregoing bid; that they executed said bid in behalf of said corporation by authority of its Board of Directors; that said bid is genuine and not sham or collusive and is not made in the interests of or on behalf of any person not herein named, and that they have not and said bidder has not directly or indirectly induced or solicited any other person or corporation to refrain from bidding; that they have not and said bidder has not in any manner sought by collusion to secure to themselves or to said corporation an advantage over other bidders.

Subscribed and sworn to before me at _____, in said County and State,

this _____day of _____, A.D. 20_____,

_____

*Notary Public, _____County,_____

My Commission expires_____,20_____

FOR PARTNERSHIP

STATE OF _____

S.S.

COUNTY OF _____

_____being duly sworn, deposes and says that they are a member of the firm of _____, a co-partnership, making the above bid; that they are duly authorized to make said bid on behalf of said co-partnership; that said bid is genuine and not sham of collusive, and is not made in the interest of or on behalf of any person not therein named, and that they have and said bidder has not directly or indirectly induced or solicited any other person or corporation to refrain from bidding, and that they have not and said bidder has not in any manner sought by collusion to secure to themselves or to said bidder any advantage over other bidders.

Subscribed and sworn to before me at _____, in said County and State,

this _____day of _____, A.D. 20_____,

_____

*Notary Public, _____County,_____

My Commission expires_____,20_____

FOR AGENT

STATE OF _____

S.S.

COUNTY OF _____

_____being duly sworn, deposes and says that they executed the within and foregoing bid in behalf of _____, the bidder therein named, they having been theretofore lawfully authorized, as the agent of said bidder, so to do; that said bid is genuine and not sham or collusive and not made in the interests of or on behalf of any person not therein named, and that they have not and said bidder has not directly or indirectly induced or solicited any bidder to put in a sham bid; that they have not and said bidder has not directly or indirectly induced or solicited any other person or corporation to refrain from bidding, and that they have not and said bidder has not in any manner sought by collusion to secure to themselves or to said bidder any advantage over other bidders.

Subscribed and sworn to before me at _____, in said County and State,

this _____day of _____, A.D. 20_____,

_____

*Notary Public,_____County,_____

My Commission expires_____,20_____

NOTE: If executed outside of the State of Michigan, certificate by the Clerk of the Court of Record, authenticating the Notary's Signature and authority should be attached.

DIGESTER PIPING FABRICATION PROJECT

SUBMITTAL FORM FOR QUESTIONS

Due December 2, 2022 by 10:00 A.M.

1.

2.

3.

4.

5.

Company Name	
Representative Name	
Address:	
Telephone Number	
Email Address	

_____

(Representative Signature) **Date**

Please email this form to the attention of Lauren Rowley, Purchasing Manager

Email: lrowley@cityofflint.com

CITY OF FLINT
WATER POLLUTION CONTROL
DIGESTER PIPING FABRICATION PROJECT

The City of Flint Water Pollution Control (herein referred to as WPC) is seeking qualified mechanical contractors to fabricate and install piping in its digester building. This bid shall include all necessary fabrication and installation listed in the bid specifications below. ***All prosective Bidders must attend the mandatory pre-bid meeting, failure to do so will result in the rejection of that vendor's bid proposal.***

TOTAL PROJECT SCOPE

The City of Flint Water Pollution Control proposes to modify and improve the feed piping for the digestion process. The project will focus on the fabrication and installation of piping/pumps for the digester control building and basement. The project scope includes the following major components of work:

1. Installing new feed pumps, wasting pump, and mixing pump.
2. Fabrication and installation of new piping.
3. Relocating controls valves.
4. Unplugging Rotomix system.

INTRODUCTION

It is the intent of these documents in combination with the other Bidding Documents to provide the Contractor with a clear understanding of their responsibilities and the minimum standards required for a complete and workable system.

The Contractor is to supply all materials and labor indicated in, implied by or associated with, those items/systems mentioned in the scope of work, drawings, special conditions, safety program and other documentation included in this bid package, with the exception of those specific items identified as free issue items.

The term "pipework" is used as a general term in this Scope of Work, and bid documents, and is intended to include all fittings, flanges, threadolets for indicating devices, pipe, etc. which is required for a complete and workable system.

All work shall be consistent with the best accepted industry trade practices and standards. All pipework shall be fabricated in a true and tradesman like manner. Any improper workmanship will be restored at the Contractor's expense.

PRICE SUMMARY

The Bidder's Price for each Bid Item shall be complete in every respect, so that at the discretion of WPC, a unit may be deleted for the full amount quoted, prior to the Award of a Contract, without affecting the prices of other Bid Items quoted.

Scope of Work

The City of Flint uses anaerobic digestion (AD) for the processing of wastewater sludges. The main process occurs within the AD complex (aka the digester building). In 2010, major renovations and additions to the AD complex were completed. The AD complex has two (2) digesters, commonly known as the South and North digesters. The North digester was renovated as part of the 2010 renovations and the South digester was completed in 2019.

With a single digester feed pump that services both digesters the City nw finds that it has inadaqute feed capacatiy and redunadancy that musts be addressed. The City is looking to replace and add a additional feed pump, replace a wasting pump, replace the east mixing pump and make some piping modifications. As part of this contract the City is seeking qualified mechanical contractors to fabricate and install piping, valves and pumps for the digester complex.

This proposal shall include all 304 sch10 stainless steel piping, valves, all welding, flanges, and threadolets needed. This proposal is to include the measuring and pipe fabrication as the City will install the piping. Contactor shall also install two density meters in the feed piping; meters shall be provided by the City. The proposal shall include what is listed below and what is provided for in the drawings in Appendix A, B C, D, E, F, G and H.

1. Appendix A - New Feed Piping Improvements Drawings
2. Appendix B - Welded Steel Pipe & Fittings
3. Appendix C - Cast In Place Concrete
4. Appendix D - Concrete Toppings
5. Appendix E - Stainless Steel Sludge Piping & Fittings
6. Appendix F - Basic Process Mechanical Materials and Methods
7. Appendix G - Process Mechanical hangers & Supports
8. Appendix H - Pipe Pressure Test

The Contractor shall assume responsibility for the verification of orientation and alignment of all equipment to form part of the total system and make allowances for any dimensional discrepancies.

All drawings provided as part of this specification are for reference only. The City does not warrant that they are complete accurate. The Contractor shall be responsible for field verification of all dimensions.

Warranty

The Contractor shall expressly represent, warrant and agree that all goods, equipment, material, and fabrication provided or performed on or off City premises relative to this Contract will:

1. Be free of defects in workmanship and materials for a period of twelve (12) months after the delivery of the piping to the City.
2. Conform in all respects to the City's specifications, requirements or other descriptions.
3. Be fit for the purpose(s) of intended use.
4. Be new and good quality, merchantable, of good workmanship, of materials best suited for the intended purposes, and free from defects of any kind.

Any usage statement, guarantee, or warranty stated in the Bid relating to equipment, materials, service, or Work will be superseded by the terms and conditions stated herein or in their absence by the following:

1. If said equipment, material, service or Work is found to be defective in workmanship and materials, design fails, or is found to be nonconforming with the terms and conditions of this Contract with the time as specified in this section, it shall, at the City's option, be repaired or replaced at the City's location by the Contractor at absolutely no cost to the City.
2. All items delivered or supplied hereunder will be free and clear of all liens, encumbrances, claims, and security interests of whatever nature and substance. Upon request, the Contractor will supply the City with documentation satisfactory to it evidencing the absence of such liens, encumbrances, claims, and security interests.

BID FORM

Description	Unit	QTY	Amount
Piping for feed piping improvements.	LS	1	
Installation of pumps.	LS	1	
TOTAL			

1. Failure to use this bid form shall result in bid disqualification.
2. Failure to bid on all items shall result in an "incomplete bid" determination.
3. **List value-added considerations on a separate sheet of paper.**

Terms:_____ Dest:_____ Fed. ID#:_____

CONTRACTOR NAME:_____

ADDRESS:_____

CITY/STATE/ZIP:_____

PHONE:_____FAX:_____

SIGNED:_____DATE:_____

PRINTED:_____TITLE:_____

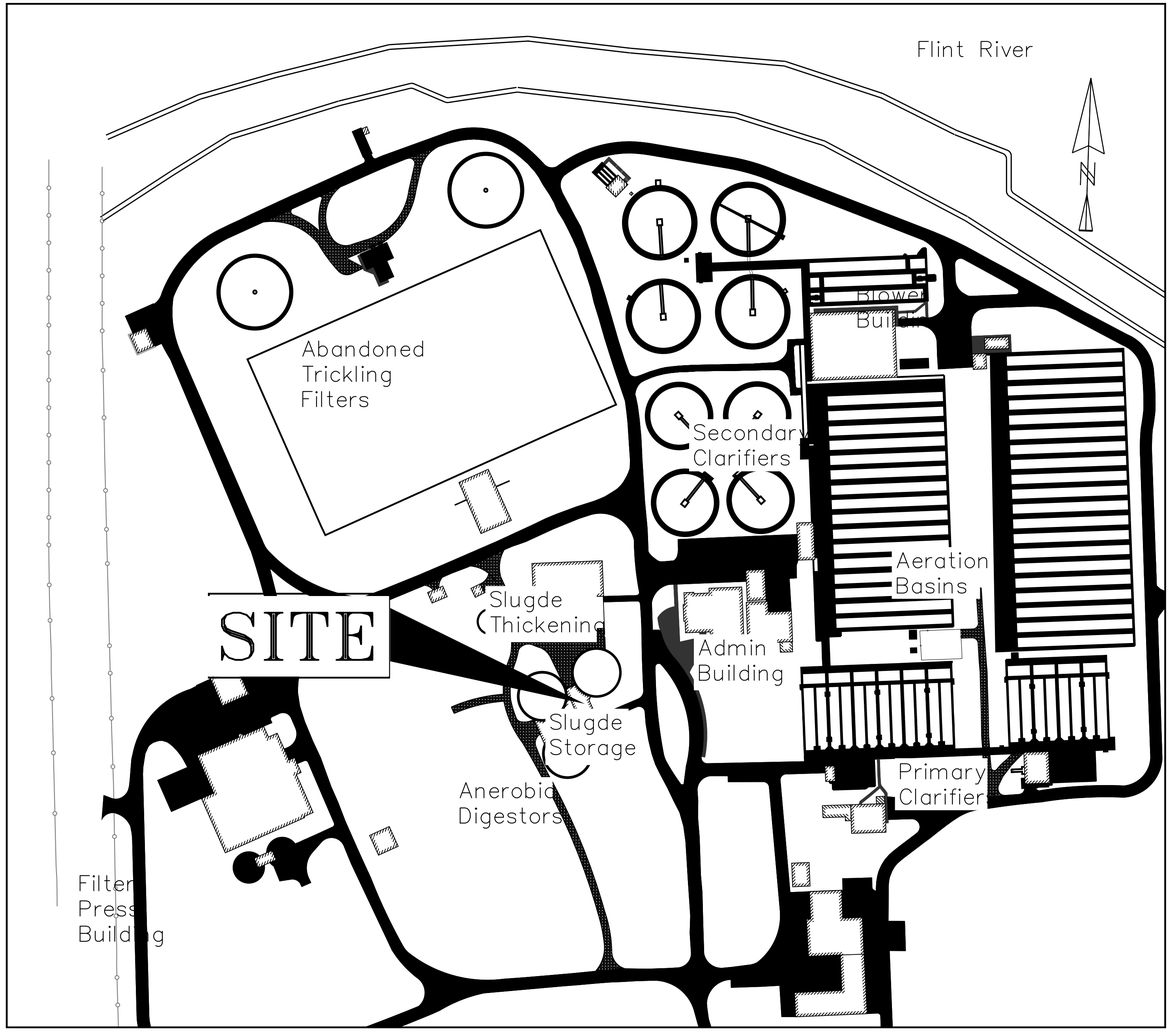
Please submit original plus one copy.

Bid results may be viewed next business online at www.cityofflint.com/purchasing.

APPENDIX A

CITY OF FLINT, MICHIGAN
WATER POLLUTION CONTROL FACILITY
DIGESTER BUILDING IMPROVEMENTS
2022

Index of Sheets



THIS IS TO CERTIFY THAT GOOD ENGINEERING PRACTICES HAVE BEEN UTILIZED IN THE DESIGN OF THIS PROJECT AND THAT ALL MINIMUM STANDARDS AS DELINEATED BY THE CITY OF FLINT, MICHIGAN HAVE BEEN MET, INCLUDING THOSE STANDARDS GREATER THAN MINIMUM WHERE IN MY OPINION PROTECT THE SAFETY OF THE PUBLIC.

PLAN PREPARED BY:

STATE OF MICHIGAN
CHAD L. ANTLE
6201057066
PROFESSIONAL ENGINEER

2022 08 04

CITY OF FLINT
MICHIGAN

DIGESTER BUILDING

PIPING IMPROVEMENTS

City of Flint Water Pollution Control
G-4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480

east tank

pickle pit

P-105

P-104

depackager

P-103

dewatering

P-100

P-101

P-102

P-501

P-502

P-601

P-602

digestate tank
(blue tank)

north digester

south digester

East digestate #1

West digestate #2

6" Primary Scum

6" Primary Sludge

6" digester feed

6" FIT

6" east tank feed

6" digester bypass

6" digester wasting

4" depack feed

4" FIT

4" DIT

4" digester wasting

Digester Feed

CITY OF FLINT
MICHIGAN

DIGESTER BUILDING IMPROVEMENTS
PIPING IMPROVEMENTS

City of Flint Water Pollution Control
G-4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480

SCALE: 1" = 20'

0 10 20 40 80

NORTH DIGESTER

EAST STORAGE TANK

BLIND FLANGE

EX PIPING NOT SHOWN FOR CLARITY

6" TEE ON EXISTING 6" SS SCH 10 PIPING

6" PLUG VALVE

EX. FLOW METER TO BE RELOCATED TO THIS APPROXIMATE LOCATION – FLOW METER TO BE INSTALLED IN LOCATION IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS

EX. 4" SS SCH 10 PIPING

EX. FLOW METER TO BE RELOCATED

D–D / 4

6"SS PIPE TO EAST DIGESTER BASEMENT

EX. 6 SS PIPE TO NORTH DIGESTER

6" MOTORIZED PLUG VALVE – PROVIDED BY OWNER

6" SS 304 PIPE

EX HYDRONIC HEATING UNIT – POSITION/LOCATION TO BE ADJUSTED AS NECESSARY

6" X 6" X 4" WYE

OWNER PROVIDED 4" FLOW METER

EAST TANK MIXING PUMP

EX NORTH DIGESTER MIXING PUMP

PROVIDE 1" THREADOLET AND STAINLESS STEEL BALL VALVE ON TOP OF PIPE

4" SWING CHECK VALVE

6" SS 304 PIPE

4" SS 304 PIPE

EX 6" SS DIGESTATE RECIRCULATION PIPE

INSTALL 6" SWING CHECK VALVE AT EXISTING PIPE FLANGE JOINT

EX 6" SS DIGESTATE RECIRCULATION PIPE

INSTALL 6" STEEL BLIND FLANGE

EX SOUTH DIGESTER MIXING PUMP

4" SS 304 PIPE

PROVIDE 1" THREADOLET AND STAINLESS STEEL BALL VALVE AT HIGHEST ELEVATION OF PIPING

EX 6" SS 304 PIPE TO SOUTH DIGESTER

EX 4" SS 304 PIPE FROM DEPACK TO EAST TANK

CONNECT TO EX 4" SS PIPE AT ELBOW. INSTALL TEE TO CONNECT TO EX. VERTICAL SS PIPE AND RECONNECT ELBOW ON TEE TO ALLOW FOR INSTALLATION OF NEW 4" SS PIPING.

EX 6" SCH 40 PVC PIPE

C–C / 4

SOUTH DIGESTER

CITY OF FLINT
MICHIGAN

2022 ANAEROBIC DIGESTERS

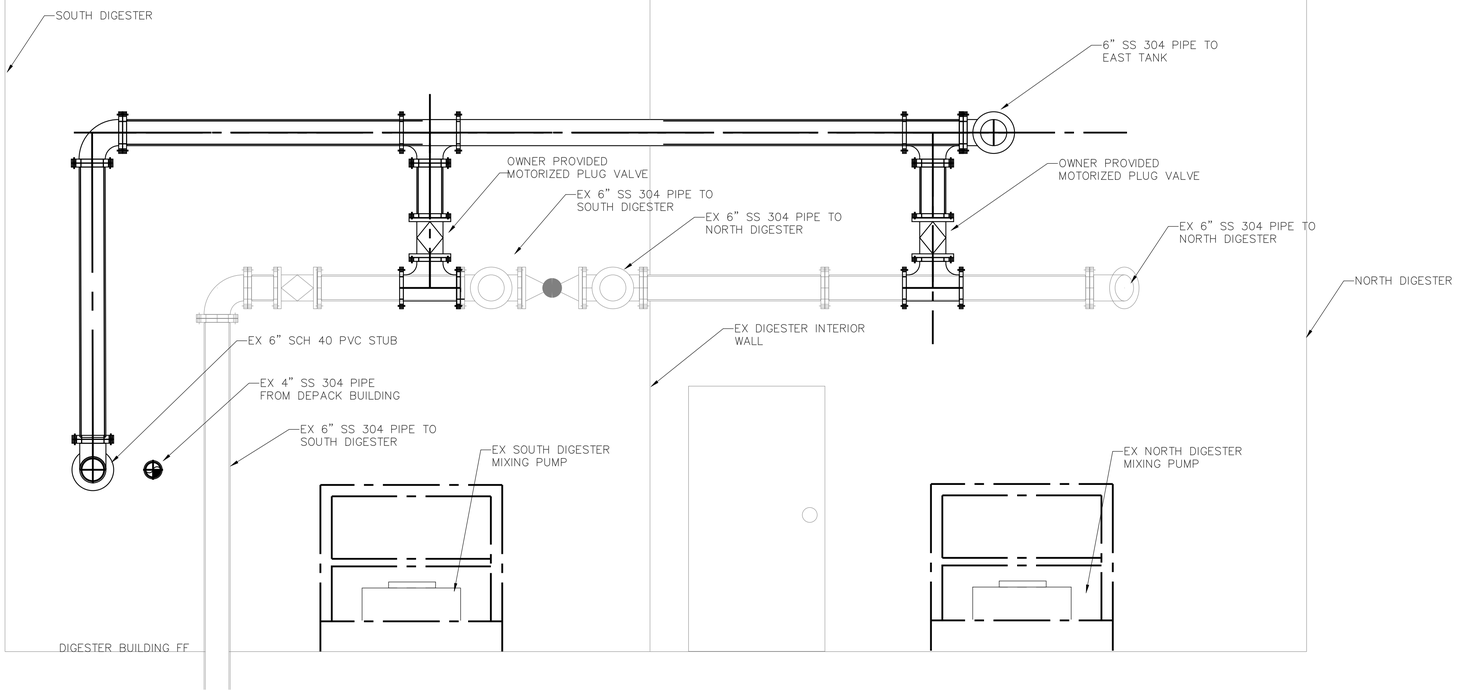
FEED PIPING IMPROVEMENTS

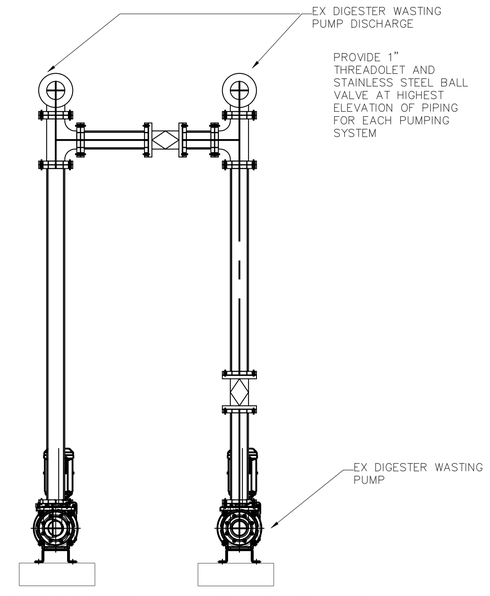
City of Flint Water Pollution Control
G–4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480

WEST MAIN FLOOR – DIGESTER BUILDING

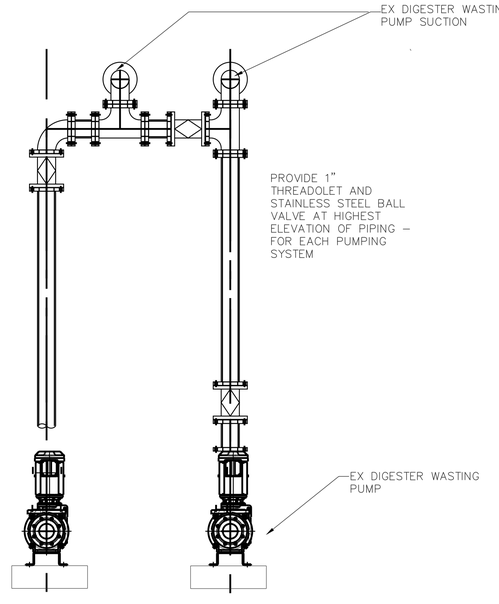
SECTION C/4
SCALE: 1"=20'





DIGESTER WASTING PUMPS DISCHARGE

SECTION A/4
SCALE: 1"=20'

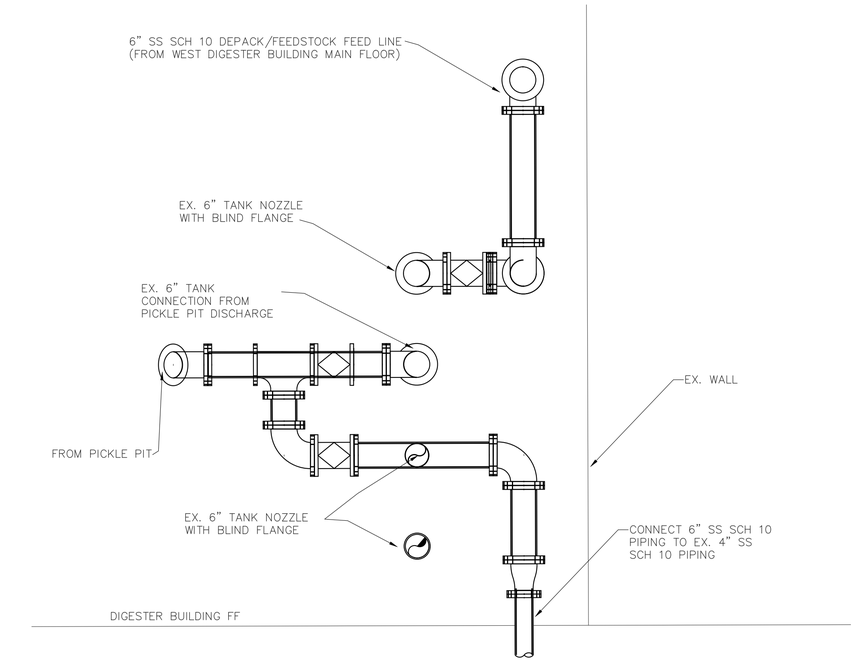


DIGESTER WASTING PUMPS SUCTION

SECTION B/4
SCALE: 1"=20'

FABRICATION GENERAL NOTES

1. CONTRACTOR SHALL RECONFIGURE EXISTING PIPING TO PROVIDE FUNCTIIONAL SYSTEM AS PROVIDED HEREIN.
2. REUSE EXISTING PIPING, VALVES, AND APPURTENANCE IS PERMITTED WITH PERMISSION OF THE OWNER.
3. ARRANGE OF ISOLATION VALVES TO BE LOCATED NEAR INLET AND DISCHARGE OF PUMPS. SELECTED LOCATION TO BE APPROVED BY OWNER PRIOR TO INSTALLATION
4. OWNER TO PROVIDE ALL PIPING, VALVES AND FITTINGS.
5. CONTRACTOR TO PROVIDE BALANCE OF ALL NECESSARY LABOR, MATERIALS AND EQUIPMENT TO INSTALL A FUNCTIONAL SYSTEM AS DETAILED HEREIN.



FEEDSTOCK FEED TO EAST TANK PICKLE PIT DISCHARGE TO BASEMENT

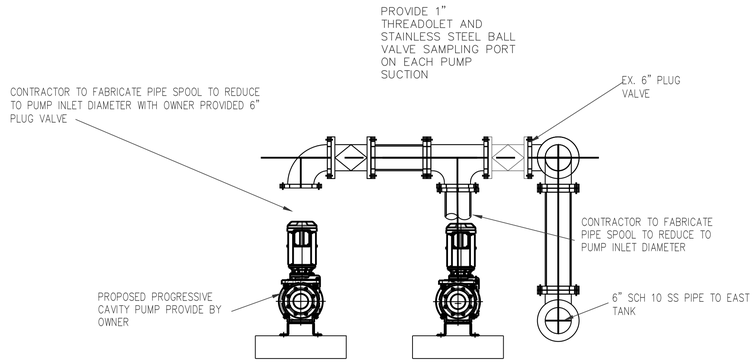
SECTION D/4
SCALE: 1"=20'

CITY OF FLINT
MICHIGAN

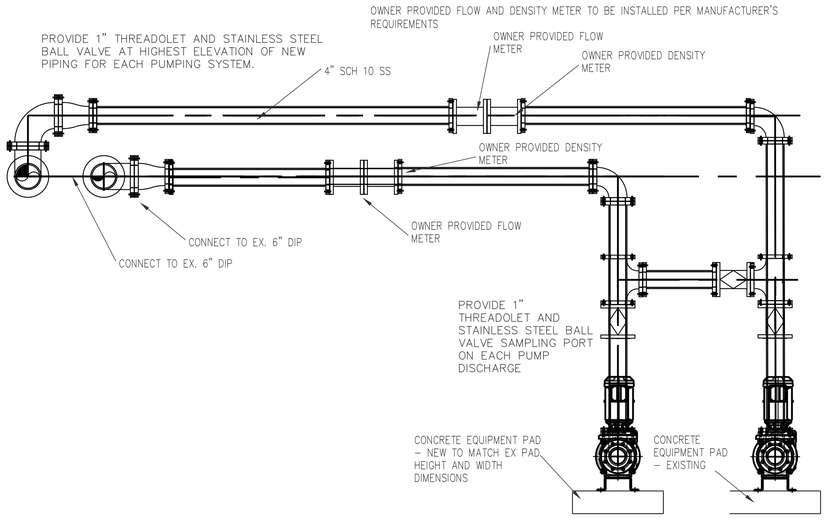
2022 ANAEROBIC DIGESTERS

FEED PIPING IMPROVEMENTS
City of Flint Water Pollution Control
G-4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480



SECTION A/5
SCALE: 1"=20'



SECTION B/5
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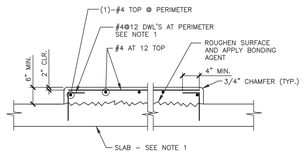
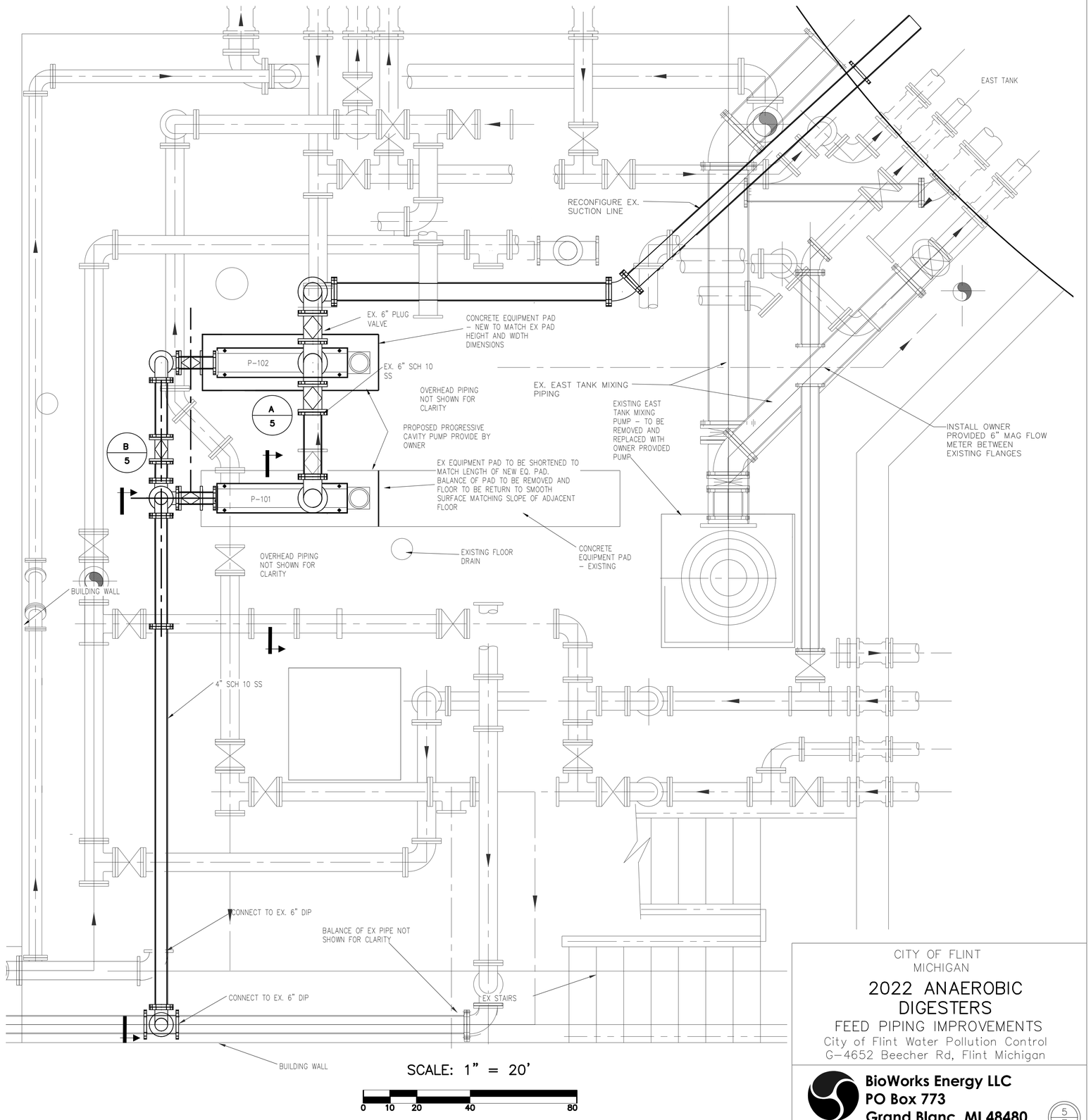


EQUIPMENT PAD DETAIL ON CONC. SLAB
NOT TO SCALE

DETAIL NOTES:
1. COORDINATE EQUIPMENT PAD SIZE AND ANCHOR LOCATIONS WITH MECHANICAL DRAWINGS AND EQUIPMENT MFR.



SCALE: 1" = 20'

0 10 20 40 80

CITY OF FLINT
MICHIGAN

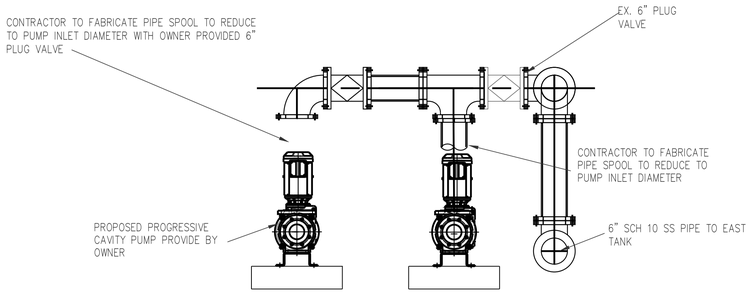
2022 ANAEROBIC DIGESTERS

FEED PIPING IMPROVEMENTS

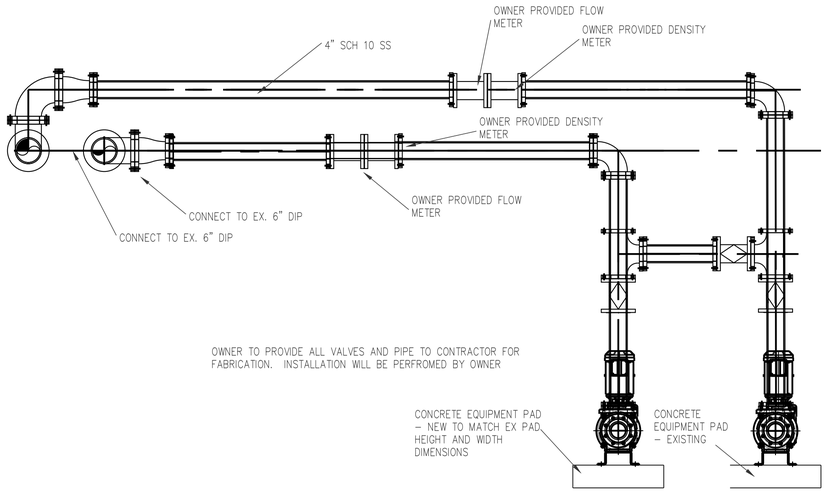
City of Flint Water Pollution Control
G-4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480

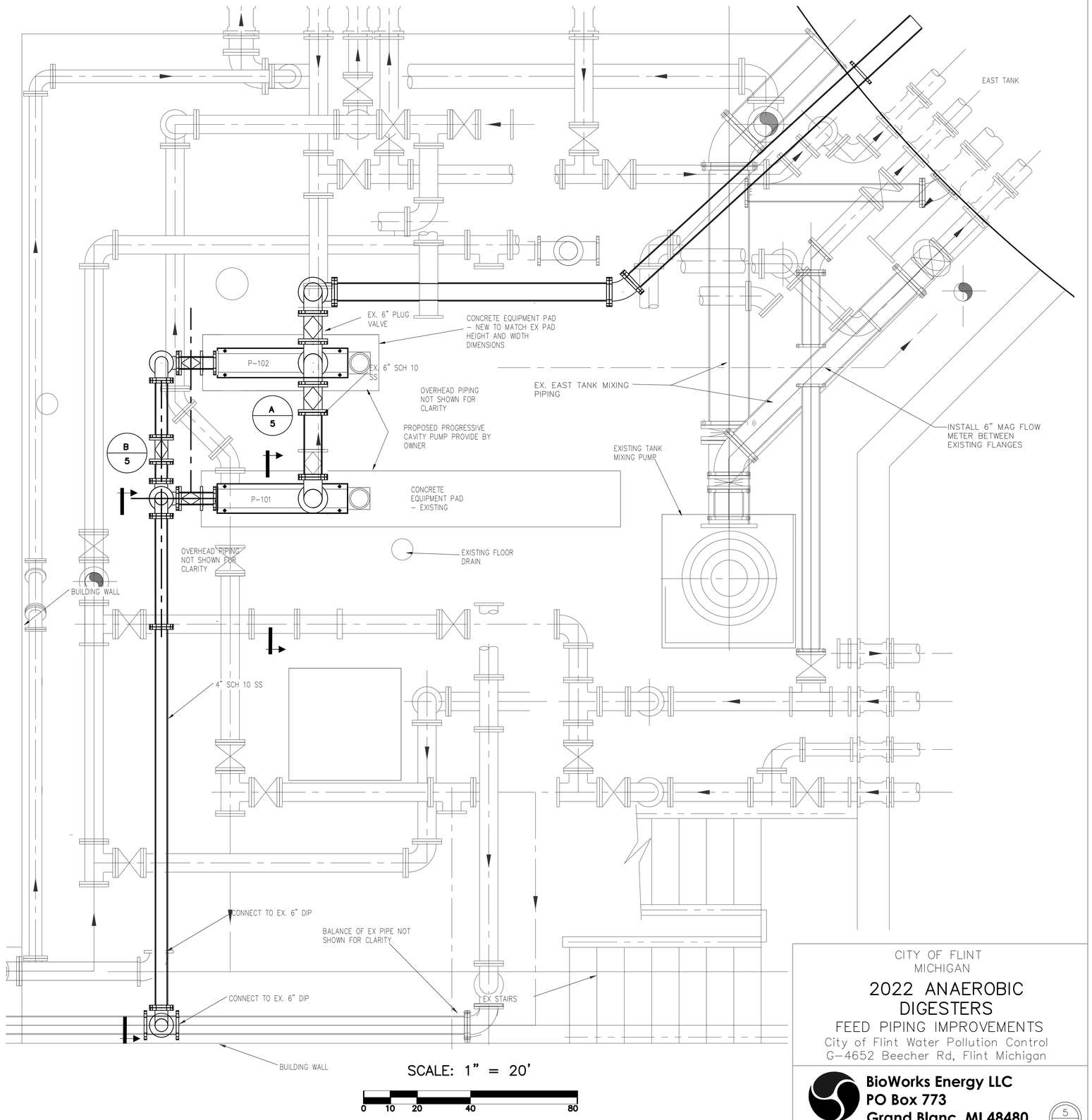
OWNER TO PROVIDE ALL VALVES AND PIPE TO CONTRACTOR FOR FABRICATION. INSTALLATION WILL BE PERFROMED BY OWNER



SECTION A/5
SCALE: 1"=20'



SECTION B/5
SCALE: 1"=20'



SCALE: 1" = 20'

0 10 20 40 80

CITY OF FLINT
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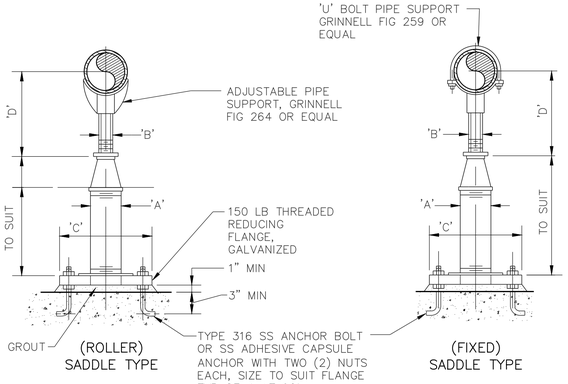
2022 ANAEROBIC DIGESTERS

FEED PIPING IMPROVEMENTS

City of Flint Water Pollution Control
G-4652 Beecher Rd, Flint Michigan

BioWorks Energy LLC
PO Box 773
Grand Blanc, MI 48480



NOTE:
1. FOR AERATION AIR PIPING ADD 2" OF INSULATION W/ FIBERGLASS JACKET. AT PIPE SUPPORTS ADD PROTECTION SADDLES.

ADJUSTABLE PIPE SUPPORTS

NOT TO SCALE

408

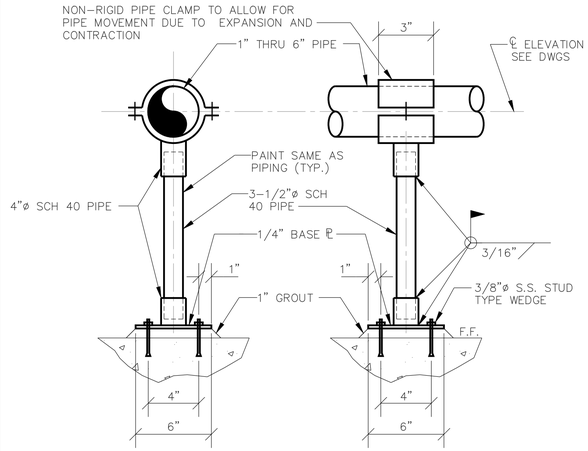
ADJUSTABLE PIPE SUPPORT APPROX DIMENSIONS IN INCHES					
PIPE SIZE	A	B	C	D MIN	D MAX
2-1/2"	2-1/2"	1-1/2"	9"	8"	11-1/2"
3"	2-1/2"	1-1/2"	9"	8-1/4"	11-3/4"
3-1/2"	2-1/2"	1-1/2"	9"	8-1/2"	12"
4"	3"	2-1/2"	9"	10-1/4"	14"
6"	3"	2-1/2"	9"	11-5/8"	15-1/4"
8"	3"	2-1/2"	9"	13-5/8"	16-1/4"
10"	3"	2-1/2"	9"	14-5/8"	18-1/4"
12"	3"	2-1/2"	9"	15-5/8"	19-3/4"
14"	4"	3"	11"	18-5/8"	20-3/4"
16"	4"	3"	11"	19-7/8"	22-1/4"
18"	6"	3-1/2"	13-1/2"	21-1/4"	24"
20"	6"	3-1/2"	13-1/2"	23-1/4"	25-1/2"
24"	6"	4"	13-1/2"	26-1/2"	28-1/4"
30"	6"	4"	13-1/2"	29-5/8"	31-1/2"
32"	6"	4"	13-1/2"	30-5/8"	32-3/4"
36"	6"	4"	13-1/2"	32-5/8"	34-3/4"

NOTE:
1. UNDER VALVES, METERS OR OTHER SPECIAL APPURTENANCES A FABRICATED SUPPORT PIECE MAY BE UTILIZED AS ACCEPTABLE TO ENGINEER.

ADJUSTABLE PIPE SUPPORTS

NOT TO SCALE

409

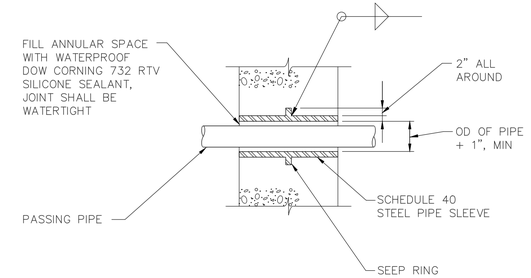


NOTES:
1. EMBEDMENT DEPTH PER MANUFACTURER'S RECOMMENDATIONS.
2. PROVIDE BITUMASTIC COATING BETWEEN BASE PLATE AND GROUT.
3. FOR EXTERIOR LOCATIONS, PROVIDE 3' X 3' X 12" THICK CONCRETE PAD, WITH 4 – #4 BARS TOP AND BOTTOM EACH WAY (GOVERNED BY OVERTURNING) WITH TOP OF PAD AT FINISHED GRADE. MAXIMUM SPACING BETWEEN SUPPORTS SHALL BE 12'.

PIPE SUPPORT DETAIL

NOT TO SCALE

410

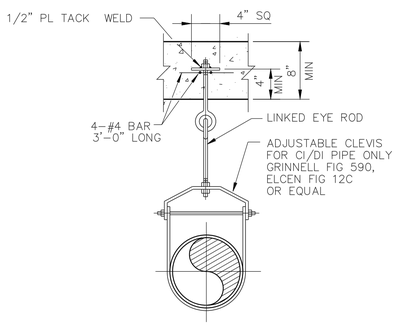


NOTE:
1. DO NOT USE WHERE SUBJECT TO HYDROSTATIC PRESSURE. PAINT ENTIRE SLEEVE AND SEEP RING AS SPECIFIED.

TYPE 'B' PIPE SLEEVE

NOT TO SCALE

411



PIPE HANGER RODS & SUPPORT SPACING					
PIPE DIA (INCHES)	ROD DIA (INCHES)	MAX SUPPORT SPACING (FEET) STL PIPE	MAX SUPPORT SPACING (FEET) CI/DI PIPE	WEIGHT LIMIT (LBS) TYPE 'A'	WEIGHT LIMIT (LBS) TYPE 'B'
1" & SMALLER	3/8"	5'	MIN 1 HANGER PER PIPE LENGTH AND FIT MAX SPACING 5 FEET– LOCATE HANGER CLOSE TO EACH CONNECTION	610	---
1-1/2" TO 2	3/8"	5'		610	---
2-1/2" TO 3-1/2"	1/2"	10'		1130	---
4" TO 5"	5/8"	10'		1430	---
6"	3/4"	10'		1430	3800
8", 10", 12"	7/8"	10'		---	3800
14", 16"	1"	10'		---	3800

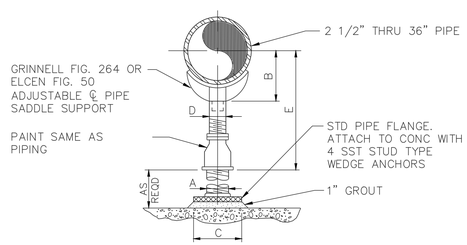
NOTE:
1. GALVANIZE ALL PARTS AFTER FABRICATION.

TYPE 'B' FOR HANGER RODS 7/8" DIA AND LARGER, AND MIN 8" THICK CONCRETE

NOT TO SCALE

412

DIMENSION TABLE						
PIPE SIZE	A	B	C	D	E MIN	E MAX
2-1/2"	2-1/2"	3-1/2"	9"	1-1/2"	8"	13"
3"	2-1/2"	3-3/4"	9"	1-1/2"	8-1/4"	13-1/4"
3-1/2"	2-1/2"	4"	9"	1-1/2"	8-1/2"	13-1/2"
4"	3"	4-1/4"	9"	2-1/2"	9-1/4"	14"
5"	3"	4-7/8"	9"	2-1/2"	10"	14-3/4"
6"	3"	5-1/2"	9"	2-1/2"	10-1/2"	15-1/4"
8"	3"	6-7/8"	9"	2-1/2"	11-3/4"	16-1/2"
10"	3"	8-1/2"	9"	2-1/2"	13-1/2"	18-1/4"
12"	3"	9-15/16"	9"	2-1/2"	15"	19-3/4"
14"	4"	10-15/16"	11"	3"	16-1/4"	20-3/4"
16"	4"	12-3/8"	11"	3"	17-3/4"	22-1/4"
18"	6"	13-7/8"	13-1/2"	3-1/2"	19-1/2"	24"
20"	6"	15-3/8"	13-1/2"	3-1/2"	21"	25-1/2"
24"	6"	17-15/16"	13-1/2"	4"	23-3/4"	28-1/4"
30"	6"	21-5/16"	13-1/2"	4"	27"	31-1/2"
32"	6"	22-1/2"	13-1/2"	4"	28-1/4"	32-3/4"
36"	6"	24-1/2"	13-1/2"	4"	30-1/4"	34-3/4"

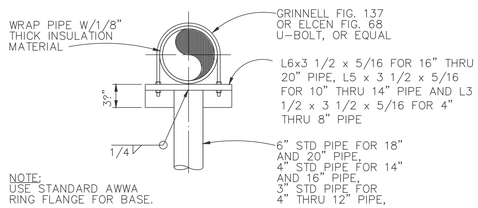


NOTES:
1. PROVIDE HALF ROUND RIGID INSULATION AND INSULATION PROTECTION SHIELD, SIMILAR TO GRINNELL FIGURE 167 OR ELCEN FIGURE 219, WHERE PIPING IS INSULATED.
2. PROVIDE NEOPRENE WAFFLE ISOLATION PAD, SIMILAR TO MASON TYPE 'W' OR KORFUND KORPAD 40, UNDER SUPPORT FOOT WHEN PIPING IS ISOLATED OR SUPPORT IS ADJACENT TO MECHANICAL EQUIPMENT.
3. FOR BASE, HEIGHT AND FLANGE DIMENSIONS, SEE TABLE.

PIPE SUPPORT (TYPE A)

NOT TO SCALE

413

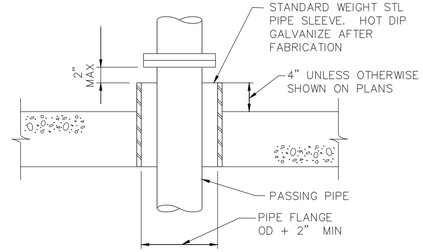


NOTE:
USE STANDARD AWWA RING FLANGE FOR BASE.

PIPE SUPPORT

NOT TO SCALE

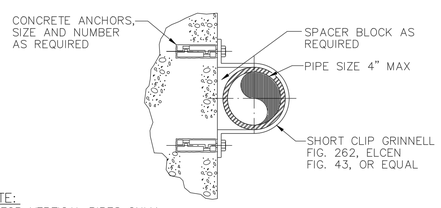
414



FLOOR SLEEVE

NOT TO SCALE

415

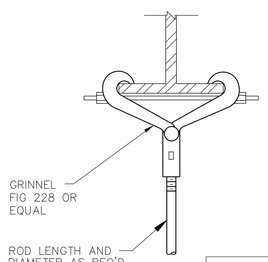


NOTE:
1. FOR VERTICAL PIPES ONLY.

PIPE SUPPORT

NOT TO SCALE

416



BEAM CLAMP

NOT TO SCALE

417

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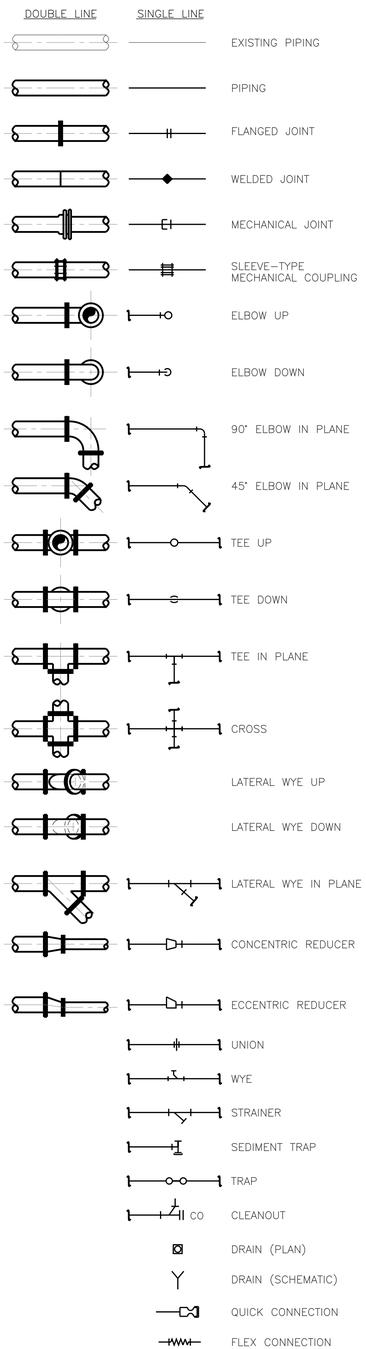
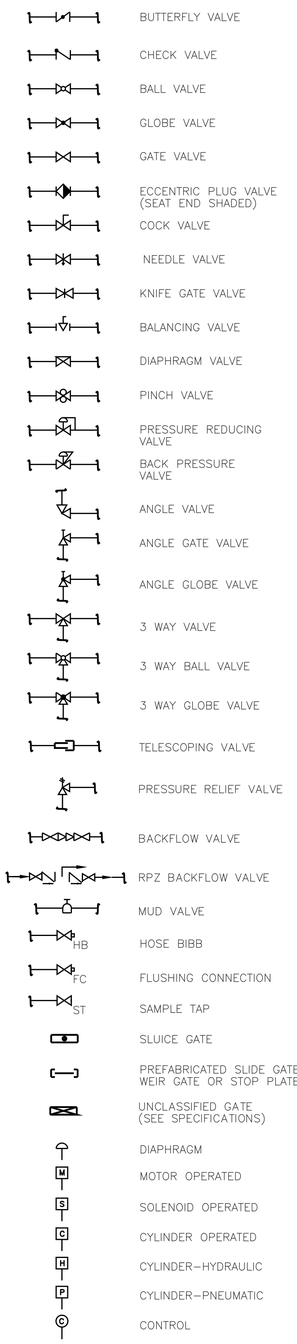
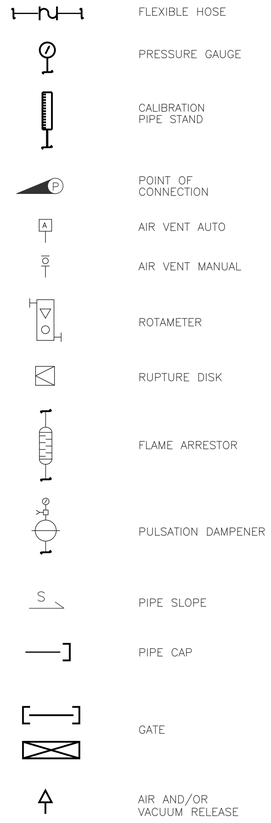
PIPE AND FITTING SYMBOLS



VALVE AND GATE SYMBOLS



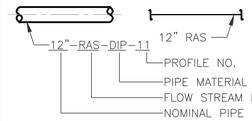
MISCELLANEOUS SYMBOLS



MECHANICAL EQUIPMENT DESIGNATION

AC	AIR COMPRESSOR
AS	AIR SEPARATOR
AG	AGITATOR/MIXER
BL	BLOWER
BO	BOILER
BUU	BIOGAS UPGRADE UNIT
CD	CONDENSATE AND SEDIMENT TRAP
CDU	CENTRIFUGE DEWATERING UNIT
EXP	EXPANSION TANK
FA	FAN
FT	FLOW METER
MT	GRAVITY BELT THICKENER
HEX	HEAT EXCHANGER
MC	MACERATOR
P	PUMP
PO	POLYMER FEED SYSTEM
SST	SLUDGE STORAGE TANK
TA	TANK

PIPE DESIGNATIONS

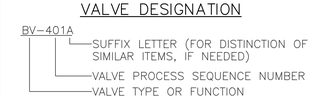


DIP	DUCTILE IRON
FRP	FIBERGLASS REINFORCED PLASTIC
GS	GALVANIZED STEEL
PVC	POLYVINYL CHLORIDE
SS	STAINLESS STEEL

FLOW STREAM DESIGNATIONS

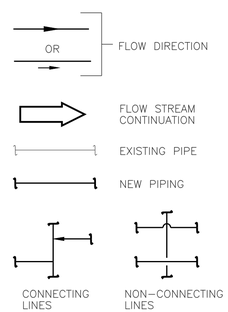
AHP	AIR, HIGH PRESSURE
ALP	AIR, LOW PRESSURE
BG	BIOGAS, DIGESTER GAS
DS	DIGESTED SLUDGE
DSR	DIGESTED SLUDGE RECIRCULATION
FE	FILTER EFFLUENT
FI	FILTER INFLUENT
FLT	FILTRATE
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
NG	NATURAL GAS
NPW	NON–POTABLE WATER, SERVICE WATER
PD	PLANT DRAIN
PWS	POTABLE WATER SUPPLY
PMR	POLYMER
RW	RAW WASTEWATER
SCM	SCUM
SD	STORM DRAIN
SL	SLUDGE
SW	SERVICE WATER, NON–POTABLE WATER
TS	THICKENED SLUDGE
UTIL	UTILITY WATER
WAS	WASTE ACTIVATED SLUDGE

VALVE DESIGNATION



ARV	AIR RELEASE VALVE
BAV	BALL VALVE
BFV	BACKFLOW (PREVENTER) VALVE
BV	BUTTERFLY VALVE
CV	CHECK VALVE
DV	DIAPHRAGM VALVE
GLV	GLOBE VALVE
GV	GATE VALVE
KGV	KNIFE GATE VALVE
MOV	MOTOR OPERATED VALVE
MV	MUD VALVE
PIV	PINCH VALVE
PLV	PLUG VALVE
PRV	PRESSURE REDUCING VALVE
PSV	PRESSURE SUSTAINING VALVE
RV	RELIEF VALVE
SV	SOLENOID VALVE
TV	TELESCOPING VALVE

FLOW STREAM LINE SYMBOLS



NOTE:
SEE ELECTRICAL DRAWINGS FOR HAZARDOUS ATMOSPHERE CLASSIFICATIONS

INTERIOR AND EXTERIOR PROCESS PIPING SCHEDULE

PLANT PIPING SYSTEM	PIPE MATERIAL AND JOINING
SLUDGE THICKENED SLUDGE DIGESTED SLUDGE OTHER SLUDGES	DUCTILE IRON PIPE, DUCTILE IRON FITTINGS AND SPECIALS; PIPING AND FITTINGS SHALL BE FLANGED OR MECHANICAL GROOVED JOINTS FOR INTERIOR OR ABOVE GRADE SERVICE; PIPING AND FITTINGS SHALL BE SDR 11 HDPE FOR BURIED SERVICE. PIPE, PIPE FITTINGS AND SPECIALS TO BE GLASS–LINED; THICKNESS CLASS OF PIPE AND CLASS OF FITTINGS TO BE AS SPECIFIED.
POLYMER SOLUTION	PVC TYPE 1, SCHEDULE 80 PIPE AND FITTINGS. SOLVENT WELDED JOINTS. SPECIALS GREATER THAN 3 INCHES TO BE FLANGED.
BIOGAS	SCHEDULE 10 TYPE 316 SS FOR ABOVE GRADE PIPING, AND SDR 11 HDPE FOR BELOW GRADE PIPING.
PLANT SEWER NON–POTABLE OR SERVICE WATER (GREATER THAN 3 INCH) POTABLE WATER (GREATER THAN 3 INCH) PLANT DRAIN	DUCTILE IRON PIPE, DUCTILE IRON FITTINGS AND SPECIALS; PIPING AND FITTINGS TO BE FLANGED OR MECHANICAL GROOVED JOINTS FOR INTERIOR OR ABOVE GRADE SERVICE; PIPING AND FITTINGS TO BE RESTRAINED JOINTS FOR BURIED SERVICE. PIPE, PIPE FITTINGS AND SPECIALS TO BE CEMENT–LINED; THICKNESS CLASS OF PIPE AND FITTINGS TO BE AS SPECIFIED.
TEMPERED POTABLE WATER	CARBON STEEL PIPE; OR SCH 80 PVC
NON–POTABLE OR SERVICE WATER (UP TO 3 INCH), POTABLE WATER (UP TO 3 INCH)	BLACK STEEL PIPE; COPPER TYPE K, OR HDPE. SCH. 80 PVC
PLANT DRAIN	PVC SDR 35 ASTM D–3034 OR DUCTILE IRON
HOT WATER	SCHEDULE 40 CARBON STEEL WITH WELDED OR FLANGED JOINTS INSULATED AND JACKETED.
GBT VENT, FILTRATE TANK VENT AND DRAIN	SCHEDULE 80 PVC

NOTES:
1. YARD PIPING SHALL HAVE A MINIMUM DEPTH OF COVER OF 42 INCHES.
2. NON–METALLIC PIPE SHALL BE INSTALLED WITH METALLIC TRACER WIRE AT THE PIPE CROWN ALONG ENTIRE ALIGNMENT.

PIPE PAINT SCHEDULE

RAW SLUDGE LINE, THICKENED SLUDGE	BROWN W/BLACK BANDS
SLUDGE RECIRCULATION SUCTION LINE	BROWN W/YELLOW BANDS
SLUDGE DRAW OFF LINE	BROWN W/ORANGE BANDS
SLUDGE RECIRCULATION DISCHARGE LINE	BROWN
SLUDGE (OR DIGESTER) GAS LINE, BIOGAS	ORANGE (OR RED)
NATURAL GAS LINE	ORANGE (OR RED) W/BLACK BANDS
NONPOTABLE WATER LINE	BLUE W/BLACK BANDS
POTABLE WATER LINE, SERVICE WATER	BLUE
CHLORINE LINE	YELLOW
SULFUR DIOXIDE	YELLOW W/RED BANDS
SEWAGE (WASTEWATER) LINE	GRAY
COMPRESSED AIR LINE	GREEN
WATER LINES FOR HEATING DIGESTERS OR BUILDINGS	BLUE W/A 6–INCH RED BAND SPACED 30 INCHES APART
FUEL OIL/DIESEL	RED
PLUMBING DRAINS AND VENTS	BLACK
POLYMER	PURPLE
PLANT DRAIN	BLACK

NOTES:
1. PIPE PAINTING SHALL BE AS SPECIFIED ABOVE AND PER THE GUIDELINES OF THE RECOMMENDED STANDARDS FOR WASTEWATER FACILITIES PREPARED BY THE GREAT LAKES – UPPER MISSISSIPPI RIVER BOARD OF STATE AND PROVINCIAL PUBLIC HEALTH AND ENVIRONMENTAL MANAGERS (10 STATES' STANDARDS).
2. THE CONTENT AND DIRECTION OF FLOW SHALL BE STENCILED ON THE PIPING IN A CONTRASTING COLOR.

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APPENDIX B

SECTION 02624

WELDED STEEL PIPE AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes requirements for providing steel pipe and fittings as indicated, in accordance with the Contract Documents.

1.2 QUALITY ASSURANCE

A. All pipe and fittings furnished under this section shall be furnished by a manufacturer with at least five years experience in supplying pipe and fittings of similar size and application.

B. All pipe and fittings furnished under this section shall be supplied by the same manufacturer.

C. All welding on steel pipelines shall be performed by certified welders having current certificates conforming to the requirements of the AWS or ASME.

D. Applicable Codes, Standards, and Specifications

1. All applicable codes, standards, and specifications shall be in accordance with the latest revisions of the following:

a. American National Standards Institute (ANSI)
b. American Welding Society (AWS)
c. American Society for Testing and Materials (ASTM)
d. American Society of Mechanical Engineers (ASME)
e. American Water Works Association (AWWA)

1) C200 -Steel Water Pipe 6-in. and Larger.

2) C205 -Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4-in. and Larger -Shop Applied.

3) C206 -Field Welding of Steel Water Pipe.

4) C207 -Steel Pipe Flanges for Waterworks Service -Sizes 4in. through 144-in.

5) C208 -Dimensions for Fabricated Steel Water Pipe Fittings

6) C210 -Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

7) C606 -Grooved and Shouldered Joints.

f. National Sanitation Foundation (NSF)

1) NSF 61 -Drinking Water System Components -Health Effects

E. Welding Procedure Qualification

1. The Contractor shall furnish the Engineer with procedure specifications and qualification records of welding procedures for all pipe welding to be performed under this section, in accordance with AWS or ASME Standards, for review.

1.3 SUBMITTALS

A. Submittals shall be provided in accordance with the requirements of the General and Special Provisions and shall include, but not be limited to, the following:

1. Contractor's Drawings

a. Manufacturer's certification that all pipe, specials, fittings and other products or materials furnished under this specification comply with all applicable provisions of the references listed and this specification.

b. Layout drawings and laying schedules for steel pipe installation including location and type of joints, supports, anchors and fittings.

c. If required, calculations demonstrating the need for increases in wall thickness over the minimum specified.

d. Manufacturer's recommended procedure for welding plate or sheet, including pre-heating and type of electrode.

e. Proof that welding operators are qualified under: Sec. IX, Part A, of the ASME Boiler and Pressure Code; or AWS B2.1. For field welding, submit proof that welding operators are qualified by tests as prescribed in ANSI/AWS D1.1, Sec. 4, part C.

f. Physical and chemical properties of the steel.

g. Results of shop tests on production welds.

h. Results of shop hydrostatic tests.

i. Results of non-destructive tests, for pieces where hydrostatic tests are not practical.

j. Certified test reports for mortar lining test cylinders.

k. Detail drawings of each size pipe, fitting and special section, including type of joint and proposed mortar holdback.

l. Submit certificate of compliance before delivery of materials coated with liquid epoxy coating system stating that the system is holiday free and has been applied in accordance with and meets the requirements of AWWA C210.

2. The manufacturer shall provide (for informational purposes only) to the Engineer and Contractor, at least 90 days prior to the scheduled arrival date of the initial pipe, fittings, and appurtenances, complete instructions for unloading, handling, protection, and storage of the pipe, fittings, and appurtenances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Unloading of pipe, fittings, and appurtenances will be performed by the Contractor. Unload, handle, protect, and store the pipe, fittings, and appurtenances in accordance with the manufacturer's instructions.

B. Material and equipment damaged by handling or storage shall be repaired or replaced, at no extra cost to the Owner, by the Contractor as directed by the Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Welded steel pipe and fittings shall be as manufactured by:

1. Tennessee Metal Fabricating Corp.
2. Mid America Pipe Fabricating & Supply Co., Inc.
3. Northwest Pipe

B. Gaskets for flanged joints shall be as manufactured by:

1. Garlock Packing Co.
2. Crane Co.
3. Or Equal

C. Weldolets and threadolets shall be as manufactured by:

1. Bonney Forge and Tool Works
2. Or Equal

2.2 MATERIAL REQUIREMENTS

A. General Requirements

1. Minimum yield strength of the steel shall be 35,000 psi.

2. Allowable hoop stress under scheduled test pressure shall be no greater than 50% of the specified minimum yield strength of the steel.

3. Each length of pipe, fitting, and special section shall be marked with an identifying number which shall correspond with the number shown on the layout drawing and laying schedule.

4. Where connections between steel pipelines and other dissimilar metallic pipelines or equipment are required or shown (including ductile and cast iron), the junction of the two dissimilar metals shall be made through a dielectric flange in accordance with Section entitled "Process Piping Systems."

5. The Contractor shall be responsible for the structural design of the steel pipe. The Contractor shall submit certification that the steel pipe has been designed to resist all loads implied and reasonably anticipated.

B. Steel Pipe

1. Steel pipe shall be flanged, welded, shouldered joint, or plain end type as shown or indicated.

2. The minimum wall thickness for pipe up to and including 30-inch diameter shall be 0.250-inch for exposed or interior pipe and 0.3125-inch for buried pipe. The minimum wall thickness for all pipe larger than 30-inch diameter shall be 0.375-inch.

3. Steel pipe 6-inch in diameter and larger shall meet the requirements of AWWA C200 and shall be fabricated of plates meeting the requirements of ASTM A283 Grade D or sheets meeting the requirements of ASTM A570, Grade 33. Pipe shall be fabricated with straight-seam welds or shall be spiral-seam welded. Welds shall have a smooth uniform cross section to provide pipe with a neat external appearance. Straight-seam welded pipe shall be fabricated with not more than two longitudinal seams and with girth seams not more than eight feet apart.

4. Joints

a. Where the type of joint is not scheduled or shown, the joints shall be as required to conform to the type of pipe joints at the point of installation.

C. Fittings

1. Fittings for steel pipe shall be of suitable dimensions to match the pipe alignments shown in the Contract Documents, which generally are shown with standard AWWA ductile iron fitting dimensions, and shall be suitable for the pressures specified.

2. Fabricated steel fittings shall be fabricated from the same plates as the pipeline of which they are a part and shall meet the requirements of AWWA C200, unless otherwise shown or specified. For fabricated elbows, the wall thickness shall be the greater of the pipe plate thickness or the value calculated from the guidelines of AWWA C208 for elbows with radii of less than 2.5 pipe diameters. Fittings and elbows shall be made of pipe segments of preformed plates. 90° elbows shall be 4-piece elbows. Miter angles for elbow or bend segments shall not exceed 30 degrees, and all miters on an elbow or bend shall be the same angle. Reducers

and increasers shall have as a minimum the same laying length as standard AWWA ductile iron fittings. Fabricated steel fittings shall have plain ends or welded flanges.

3. Fabricated steel wall castings where specified shall be furnished by the pipe manufacturer. Steel wall castings shall be of the same wall thickness as the pipe to which they are connecting and shall use steel waterstops.

D. Coating and Lining

1. Wastewater Service

a. All steel pipe, fittings, and specials for wastewater service (including blind flanges) shall be cement lined. Cement lining shall be shop applied and conform to AWWA C205.

b. Exterior coating for above ground or exposed interior piping shall be as specified in Section entitled "Painting."

2. Process Air (ALP) Service

a. The steel pipe coatings and linings specified herein apply to exposed and buried steel pipe for process air (ALP). Steel pipe shall have an interior lining and exterior coating for exposed or buried service as specified. Painting of exposed piping shall be in accordance with the Division 9 Section "Painting".

b. The interior of all steel pipe shall receive 3 mils (dry) of inorganic zinc primer service rated 250ºF (dry) and 100ºF (wet) continuous, which shall be Carbo Zinc 11, as manufactured by Carboline, or equal. After the lining has cured, it shall be thoroughly washed with high pressure water to remove all detachable particles.

c. Areas of pipe to be welded shall receive 1 mil (dry) of weldable inorganic zinc primer such as Carbo Weld 11, as manufactured by Carboline, or equal.

d. The exterior of all pipe shall receive the same prime coat as that specified for the interior except for areas of pipe to be field welded.

e. The exterior of buried steel pipe shall receive, over the inorganic zinc prime coat, a multi-layered, cold-applied tape wrap system which shall be shop applied and consist of a rubber and synthetic resin primer. One (50 mils) layer of inner wrapping and two (15 mils each) layer of outer wrap for a total system build in excess of 80 mils. The cold applied tape wrap shall operate satisfactorily at a temperature of 200ºF. The wrap shall be applied in accordance with AWWA C214 and as specified herein. Windings shall be spiral wrapped with at least 1" of overlap. Successive layers shall be applied such that windings are staggered and overlay the midpoints of previous tape widths. Polyethylene backed

coatings shall be protected from sunlight at all times. The wrapping shall terminate 6" from field weld sites. The tape wrap system shall be the YG III system as manufactured by the Polyken Division of Kendall Co, Boston MA, or equal.

f. The exterior of exposed steel pipe shall receive, over the inorganic zinc prime coat, 3 mils of modified acrylic latex service rated for 300ºF (continuous) which shall be Carboline 3300 as manufactured by Carboline or equal, and 1-1/2 mil top coat of modified acrylic, service rated for 300ºF (continuous), which shall be Carboline 4685 as manufactured by Carboline, or equal.

g. After welding and pressure and leakage testing are completed, welded joints shall be thoroughly cleaned of all foreign matter and any scale or rust and primed as specified for the pipe. Finish coat and wrap shall be applied to each joint as specified for the pipe for continuous coating and wrapping of all steel piping.

h. Final touch up of inorganic zinc primer shall be with a modified aluminum epoxy mastic such as Carbomastic 15 as manufactured by Carboline or equal.

i. Shop coatings and field touch-ups shall be electrically inspected by the use of a holiday detector in accordance with AWWA C209 and the Division 9 Section "Painting".

3. Concrete encased piping shall receive a shop coat of primer (min. 3-5 mils thickness).

4. Shop applied coats shall be compatible with coating systems specified in Division 9 Section "Painting", and all pipe must have at a minimum a shop coat of primer prior to shipment to site.

5. Coatings and linings shall be sufficiently held back to allow the makeup of the joints specified.

6. Cement mortar linings at field joints shall be in accordance with Appendix A of AWWA C205.

7. Where necessary, mortar thickness shall be feathered or filleted to a smooth transition with adjoining sections.

E. Welding

1. Welding of pipe joints where shown, specified, permitted, or required shall meet the requirements of AWWA C200 and/or ANSI B31.1, ASME Code for Pressure Piping, unless otherwise specified.

2. The number of field welded joints shall be kept to a minimum; steel pipelines shall be shop fabricated in the largest pieces practical for shipping and assembly in order to minimize field welded joints. Steel pipelines shall be shop welded and

fabricated complete which includes fittings, lugs, anchors, supports, flanges, and like items, ready for field assembly before linings, as specified, are applied.

F. Flanges and Flanged Joints

1. Flanges and flange accessories shall be in accordance with AWWA C207. Flanges for steel pipe, except blind flanges, shall be of the slip-on welding type. The inside diameter of the flange for pipe sizes 30 inches and larger shall be 3/16 inch larger in diameter than the outside diameter of the pipe. The flanges shall be attached to the barrel of the pipe with two continuous fillet welds.

2. Blind flanges shall be plain faced and shall meet the requirements of AWWA C207, suitable for test pressures scheduled.

3. Bolts, stud bolts, and nuts for flanged joints shall meet the requirements of ASTM A307 Grade B, ASTM A563 Grade B, and ANSI B16.1.

4. Gaskets shall be 1/8 inch thick and shall be full-faced. Gaskets shall be of the red rubber type unless as noted. Cloth-inserted gaskets will not be allowed. Gasket for process air piping shall be suitable for 250 deg F continuous service at 25 psig.

5. Where steel pipe flanges are joined with dissimilar metals, an isolation gasket, insulating sleeves and insulating washers. The insulating sealing gasket shall be a "Linebacker" Type "E", with nitrile "quad" ring seal. The insulating sleeves shall be 1/32-inch spiral wound mylar sleeves. The insulating washers shall be 1/8-inch thick G-10 and installed on both sides of the flange. Steel washers shall also be used between the insulating washers and the bolts and nuts. The pressure rating for the insulating flange materials shall be greater than the design pressure of the piping.

G. Shouldered joints in accordance with AWWA C606 shall be provided where shown on the Drawings.

H. Sleeve-Type Couplings

1. Sleeve-type couplings shall be as specified in Section entitled “Flexible Pipe Couplings” and the Contract Drawings.

I. Harnessing

1. Harnessing of steel pipe shall be as specified in Section entitled “Flexible Pipe Couplings,” as shown on the Contract Documents, and as specified below.

2. The steel pipe joint harness shall consist of the specified number of steel pipe tie rods set diametrically opposite, generally on the horizontal diameter of the pipe, extending across the joint from fabricated bent steel plate lugs welded to the pipe at either side of the joint where shown or specified. Steel plates used in the fabrication of bent plate lugs shall conform to ASTM A36. The lugs and welds

shall be designed to develop the full strength of the tie rods. Lugs shall be shop welded to the pipe unless otherwise permitted by the Engineer.

3. Harness tie rods shall be as specified in Section 15121.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel pipelines shall be fabricated, erected and installed to the lines, elevations, locations and dimensions shown specified and required for a compete installation. In all existing structures and new structures as applicable, the Contractor shall verify all dimensions shown on the Drawings and shall take such field dimensions as may be necessary to properly fabricate, locate, erect, connect to existing work, and install all steel pipelines. Where temporary supports are used, the supports shall be sufficiently rigid to prevent shifting and distortion of the pipe. Expansion devices shall be properly adjusted so the pipelines shall be tight during expansion and contraction.

B. Install pipe, fittings, specials, and accessories in accordance with configuration shown on the Contract Drawings and the applicable provisions of the Sections entitled “Trenching, Backfilling, and Compacting” and “Pipeline Installation.”

C. Flanged Joints

1. A flanged joint consists of two flat faced surfaces with gasket, bolts and hexagonal nuts. Grease shall be removed from the flanged surface using a solvent-soaked rag and wiped clean of all dirt and grit.

2. Flanges shall be accurately aligned and supported before the gasket and bolts are inserted. The rubber gasket shall be carefully placed to ensure full flow and proper swelling of the joint. No part of the gasket shall extend beyond any bolt holes. Bolt threads shall be given a light coat of thread lubricant and then inserted and the nuts turned by hand. Bolts shall then be pulled up by a wrench employing the crossover method. Bolt lengths and required torques shall be in accordance with the manufacturer’s requirements.

3. For below grade, buried flange joints, field coat damaged shop applied epoxy coating system in accordance with requirements of AWWA C210. Field coat bolts, nuts, and uncoated metal with Royston R-28 Mastic the entire circumference of the joint. Clean area, apply and cure field applied mastic in accordance with mastic manufacturer's recommendations.

D. Sleeve-Type Couplings

1. Sleeve-type couplings and associated harnessing shall be assembled as specified in Section 15121.

E. Welded Joints

1. Field welding of pipe joints where permitted shall meet the requirements of AWWA C206 and/or ANSI B31.1 -Chapter VI, Section 136.4.2, Section 137.4 or Section 137.5. All field welding shall be approved by the Engineer prior to performing.

2. Parts to be welded shall be securely held in place and proper alignment during welding.

3. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of pipe without overlapping.

4. Welding shall be continuous around the joint and completed without interruption.

5. Welds shall be of the angle V-butt type, of sound metal thoroughly fused into the ends of the pipe and into the bottom of the V. Welds shall be free from cold shuts, pinholes, oxide inclusions or other defects.

6. Following completion of joint welding, interior cement lining at each joint shall be reapplied in accordance with Appendix A of AWWA C205, and exterior coating shall be reapplied in accordance with AWWA C203 for coal tar coatings or per the manufacturer's recommendations for other type of coatings. Any damage to the shop applied lining or coating from any cause, including welding, shall be repaired prior to acceptance.

F. Painting, linings, and coatings

1. All linings and coatings, except coatings applied as field painting, shall be shop applied unless otherwise allowed or specified.

2. Linings and coatings shall be applied to all pipe and fittings, unless otherwise specified.

3. All bolts, nuts, couplings and the like not manufactured of stainless steel shall be well coated after the joint has been made.

4. Painting shall be made in accordance with Section 09900, unless otherwise shown or specified.

G. Field Quality Control

1. All lines shall be hydrostatically tested and inspected at the pressures listed in the Contract Documents. Procedures shall be as specified in Section 02602.

H. Delivery, Storage and Handling

1. Welded steel piping and all appurtenances shall be handled in accordance with the manufacturer's recommendations.

2. Uncoated areas shall be protected from moisture.

3. During handling, shipping, joint makeup, and concrete encasement/backfilling, measures shall be taken as needed to maintain pipe roundness in accordance with requirements of AWWA C200.

4. Any damage to linings or coatings shall be repaired in accordance with the manufacturer's recommendations by the Contractor at no extra cost to the Owner.

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APPENDIX C

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes cast-in place concrete as shown on the Contract Drawings, complete including formwork, steel and fiber reinforcing, swept-in grout, admixtures, accessories, mix design, placement procedures, and finishes for foundations and footings, slabs-on-grade, walls, columns, and equipment pads and bases.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:

1. American Concrete Institute (ACI)

a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
b. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
c. ACI 301 – Structural Concrete for Buildings.
d. ACI 302 – Guide for Concrete Floor and Slab Construction.
e. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
f. ACI 305R – Hot Weather Concreting.
g. ACI 306R – Cold Weather Concreting.
h. ACI 308 – Standard Practice for Curing Concrete.
i. ACI 315 – Details and Detailing of Concrete Reinforcement
j. ACI 318 – Building Code Requirements for Reinforced Concrete.
k. ACI 350 – Environmental Engineering Concrete Structures.
l. ACI 350.1 and 350.1R – Tightness Testing of Environmental Engineering Concrete Structures and Commentary.
m. ACI 350.3R – Seismic Design of Liquid Containing Concrete Structures and Commentary.

2. American National Standards Institute (ANSI)

ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.

3. American Society for Testing and Materials (ASTM)

a. ASTM A615 – Deformed and Plain Billet Steel for Concrete Reinforcement.

b. ASTM A706 – Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcing

c. ASTM C33 – Concrete Aggregates.

d. ASTM C94 – Ready–Mixed Concrete.

e. ASTM C150 – Portland Cement.

f. ASTM C260 –Air Entraining Admixtures for Concrete.

g. ASTM C309 – Liquid membrane–forming compounds for curing concrete.

h. ASTM C494 – Chemical Admixtures for Concrete.

i. ASTM C1116 – Standard Specification for Fiber–Reinforced Concrete and Shotcrete

4. Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice.

5. 2006 International Building Code

1.3 QUALITY ASSURANCE

A. Perform work in accordance with the following:

1. ACI 117 for tolerances.

2. ACI 301 for general requirements for structural concrete.

3. ACI 305R for concreting during hot weather.

4. ACI 306R for concreting during cold weather.

5. ACI 315 for proper detailing of concrete reinforcing

6. ACI 318 for design and construction requirements for structures.

7. ACI 350 for design and construction requirements for environmental structures.

8. ACI 350.1 for tightness testing of environmental concrete structures.

9. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice.”

B. Contractor shall engage a testing agency acceptable to Engineer to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Qualify welding quality procedures and personnel according to AWS D1.4, “Structural Welding Code – Reinforced Steel.”

1.4 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, fiber reinforcement, and others if requested by Engineer.

2. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

3. Written mix design report for each type of concrete. Mix designs shall be based on field experience or trial mixtures. Submit documentation in accordance with ACI 301, Section 4.

4. Laboratory test reports for concrete materials and mix designs.

5. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

6. Proposed method of concrete curing.

7. Manufacturer's literature for admixtures used in concrete mix.

8. Name and location of concrete supplier.

1.5 COORDINATION

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

PART 2 PRODUCTS

2.1 FORM MATERIALS AND CONSTRUCTION

A. Forms for exposed finish concrete shall consist of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for unexposed finish concrete shall consist of plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form ties shall consist of factory-fabricated, adjustable-length, removable or snap-off metal designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2. At liquid containing structures use form ties with water seals.

2.2 REINFORCING MATERIALS AND CONSTRUCTION

A. Reinforcing bars shall be ASTM A615, Grade 60, deformed. Reinforcing bars to be welded shall be ASTM A706.

B. Supports for reinforcement shall consist of bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

C. Fiber reinforcement shall be as scheduled below as manufactured by Fibermesh®, W.R. Grace & Co., or equal. Dosage rate shall be as specified by the manufacturer. Use in strict accordance with the manufacture's instructions.

1. Fiber reinforcement for fiber-reinforced exterior slabs shall be Fibermesh® Inforce™ e3™, or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

2. Fiber reinforcement for fiber-reinforced dry interior slabs shall be Fibermesh® Inforce™ e3™ , or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

3. Fiber reinforcement for fiber-reinforced submerged interior slabs shall be Novomesh™ HPP 2.0, or equal, applied at the application rate of 5.0 lbs. per cubic yard of concrete.

4. Fiber reinforcement for fiber-reinforced submerged exterior concrete slabs, fillets and topping shall be Fibermesh® Inforce™ e3™ , or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

2.3 CONCRETE MATERIALS AND CONSTRUCTION

A. Portland cement shall be ASTM C150, Type II.

Use one brand of cement throughout Project unless otherwise acceptable to Engineer.

B. Normal-weight aggregates shall meet ASTM C33. Provide aggregates from a single source for exposed concrete. Use the largest aggregate possible meeting C33 and the concrete member dimensions.

For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

C. Water shall be potable.

D. Admixtures

1. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

2. Air-entraining admixture shall comply with ASTM C260 and shall be certified by manufacturer to be compatible with other admixtures.

3. Water-reducing admixture shall meet ASTM C494, Type A.

4. High-range water-reducing admixture shall meet ASTM C494, Type F or Type G.

5. Water-reducing, accelerating admixture shall meet ASTM C494, Type E.

6. Water-reducing, retarding admixture shall meet ASTM C494, Type D.

7. Accelerating admixtures shall meet ASTM C494, Type C.

8. Crystalline waterproofing admixture shall meet the following requirements:

   a. Permeability: concrete treated with admixture shall resist a pressure of 150 psi with no measurable leakage.
   b. Compressive strength: concrete treated with admixture shall exhibit a minimum 10% increase in compressive strength tested in accordance with ASTM C39.

2.4 RELATED MATERIALS AND CONSTRUCTION

A. Standard waterstops shall be ribbed polyvinyl chloride (PVC) waterstops by the Paul Murphy Plastics Co., Vinylex Corporation, Greenstreak Co. or equal, at construction joints and control joints as indicated. Waterstops at expansion joints in new construction shall be ribbed, center-bulb type PVC. Waterstops for connection to future construction shall be ribbed or split-ribbed PVC. Thickness shall be 3/8-inch. Width shall be as indicated on the Contract Drawings. PVC waterstops shall meet Corps of Engineers CRD C572. Use in strict accordance with manufacturer's instructions. PVC waterstops shall be provided with integral hog rings to facilitate tie-off to reinforcing bars.

B. Waterstops for use in chemical retaining structures shall be ribbed, center-bulb type thermoplastic rubber by Westec Barrier Technologies, or equal, at construction joints and control joints as indicated on the Contract Drawings. Thickness shall be 3/16-inch. Width shall be as indicated on the Contract Drawings.

C. Flexible chloroprene rubber strips, such as Hydrotite Type CJ or RSS by the Greenstreak Plastic Products Co., Inc., or equal, shall be used as swellable waterstops in control joints, construction joints and cold joints where indicated on the Contract Drawings. Use in strict accordance with the manufacturer's instructions.

D. Absorptive cover shall consist of burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.

E. Moisture-retaining cover shall be one of the following, complying with ASTM C171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

F. Liquid-type membrane-forming curing compound shall comply with ASTM C309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

G. Water-based acrylic membrane curing compound shall comply with ASTM C309, Type I, Class B.

Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

H. Evaporation control shall consist of monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

I. Bonding agent shall be epoxy base adhesive meeting ASTM C881, as a two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements. Bonding agent shall be equal to Sikadur 32, Hi-Mod LPL by the Sika Corporation.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

Do not use the same testing agency for field quality control testing.

B. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. Mix A - 4500-psi 28-day compressive strength; water-cement ratio 0.42 maximum; for use in all concrete exposed to water, wastewater or groundwater.

Admixtures in the mix include air entraining and water reducing; crystalline waterproofing; a high-range water reducing admixture may be added if required to facilitate pumping.

2. Mix B - 4000-psi 28-day compressive strength; water-cement ratio 0.45 maximum; for use in all other concrete work, unless noted otherwise. Admixtures in the mix include air entraining, if used in exterior exposure, and water reducing; a high-range water reducer may be added if pumped.

3. Swept-in-Grout Topping - 1 part Portland cement to 2-1/2 parts sand with minimum amount of water required for workability and placeability for swept-in-grout in secondary clarifiers. Fiber reinforcement shall be added to the grout mixture for control of micro-cracking. Fiber reinforcement shall be as previously identified for submerged exterior concrete slabs. Dosage rate shall be as specified and confirmed by the manufacturer.

4. Concrete Fill - 2000-psi, 28-day compressive strength; water-cement ratio 0.67 maximum. Concrete fill exposed to wastewater shall be 4500 psi, 28-day compressive strength; water-cement ratio 0.42 maximum. Fiber reinforcement shall be added to the fill mixture for control of micro-cracking. Fiber reinforcement shall be as previously identified for interior or exterior applications. Dosage rate shall be as specified and confirmed by the manufacturer. No admixtures are required except that a high-range water-reducing admixture may be added, if required, to facilitate pumping. Use maximum acceptable aggregate size to satisfy the concrete fill dimensions.

5. High Strength Grout - 5000-psi 28-day compressive strength; 2500-psi 7-day compressive strength water-cement ratio 0.5 maximum. Admixtures in the mix include water reducing; a high-range water reducing admixture may be added if required to facilitate pumping.

C. Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Slabs shall be not more than 3 inches.

2. Reinforced foundation systems shall be not less than 1 inch and not more than 3 inches.

3. Concrete containing a high-range water-reducing admixture (superplasticizer) shall be not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.

4. Other concrete shall be not more than 4 inches.

5. No convenience water shall be added to the mix after the truck has left the batching facility.

D. Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.

2.6 ADMIXTURES

A. Use water-reducing admixture in Type A and B mix design or high-range water-reducing admixture (superplasticizer) in Type A and B mix designs in pumped concrete, and as required, for placement and workability.

B. Use accelerating admixture in Type A and B mix designs for concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use air-entraining admixture in exterior exposed concrete in Type B mix design unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1 percent within the following limits:

1. 5.5 percent for coarse aggregate size No. 467.
2. 6 percent for coarse aggregate size No. 57 or No. 67.
3. 7 percent for course aggregate size No. 7.

D. Use admixtures in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-mixed concrete shall comply with the requirements of ASTM C94, and as specified.

For Type A and B mix designs, when air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Coordinate the installation of joint materials, and other related materials with placement of forms and reinforcing steel.

B. Forms

1. Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

a. Provide Class A tolerances for concrete surfaces exposed to view.

b. Provide Class C tolerances for other concrete surfaces.

2. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, form liners, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

3. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

4. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

5. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

6. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

7. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

C. Placing Steel Reinforcing

1. Comply with Concrete Reinforcing Steel Institute's recommended practice for “Placing Reinforcing Bars,” for details and methods of reinforcement placement and supports and as specified.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

3. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as accepted by Engineer.

4. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

D. Joints

1. Construction joints not indicated in the contract documents shall be located and installed so they do not impair strength or appearance of the structure, as acceptable to Engineer.

2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

3. Use bonding agent on old (existing concrete at the commencement of construction of this project) concrete surfaces that will be joined with new concrete and wherever a concrete topping is required, unless otherwise indicated on the Contract Drawings.

4. Provide waterstops in construction joints as indicated on the Contract Drawings. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

5. Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as foundation walls, and other locations, as indicated.

6. Construct control joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 3/16 inch wide by one-fourth of slab depth unless otherwise indicated.

   Control joints in floor slabs shall be formed as soon as possible after slab finishing as may be safely done without dislodging aggregate.

E. Installing Embedded Items

1. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

2. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

F. Preparing Formed Surfaces

1. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

2. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

G. Concrete Placement

1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

2. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

3. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location. Free fall of concrete shall not exceed five feet.

4. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

   a. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

   b. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

5. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

   a. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

   b. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

   c. Maintain reinforcing in proper position on chairs during concrete placement.

H. Cold-weather placement shall comply with the provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

b. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

I. When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

J. Finishing Formed Surfaces

1. Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

2. Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

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

L. Monolithic Slab Finishes

1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing; and where indicated.

2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

3. Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with paint or another thin film-finish coating system.

4. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

M. Apply a nonslip rough broom finish to exterior concrete platforms, tank walkways, ramps, steps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.2 QUALITY CONTROL DURING CONSTRUCTION

A. The Contractor shall employ a testing agency, approved by the Engineer, to perform tests and to submit test reports. Field testing to be performed by an ACI certified concrete field testing technician grade I.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

a. Slump testing shall be in accordance with ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

b. Air content testing shall be in accordance with ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

c. Testing of concrete temperature shall be in accordance with ASTM C1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

d. Molding of cylinders for compression testing shall be in accordance with ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-strength testing shall be in accordance with ASTM C 39; one set for each 100 cu. yd. or fraction thereof, of each concrete mix placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive testing shall consist of impact hammer, sonoscope, or other nondestructive device but shall not be used as the sole basis for acceptance or rejection.

E. The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine

adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.3 MISCELLANEOUS CONCRETE ITEMS

A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.4 CONCRETE CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by one of the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water-fog spray.

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared).

Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Cure formed concrete surfaces, including supported slabs and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.5 REMOVING FORMS

A. Formwork not supporting weight of concrete, such as sides of walls, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as slabs and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days, unless otherwise noted. Determine representative compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.6 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.7 CONCRETE SURFACE REPAIRS

A. Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

B. Mix dry-pack mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Remove and replace formed concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place,

compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior acceptance by Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.8 LEAKAGE TESTING

A. Leakage testing of fluid containing structures shall be conducted in accordance with the Section “Leakage Test for Hydraulic Concrete Structures”.

B. Structures that fail the leak test shall be repaired and re-tested.

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APPENDIX D

SECTION 03350

CONCRETE TOPPINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes fiber-reinforced concrete toppings applied over previously placed concrete slabs.

B. Types of concrete toppings include:

Fiber reinforced standard aggregate toppings.

1.2 REFERENCES

Comply with requirements of Section “Cast-In-Place Concrete” and as herein specified.

1.3 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:

Furnish product data, samples, laboratory test reports, and materials certificates as specified in Section “Cast-In-Place Concrete.”

PART 2 PRODUCTS

0.1 FIBER MANUFACTURERS

A. Subject to compliance with requirements, fiber manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Synthetic Industries, Fibermesh Division
2. W.R. Grace
3. Or equal

2.2 CEMENT AND AGGREGATES

A. Portland cement shall be ASTM C 150, Type II.

B. Normal weight aggregate shall meet ASTM C 33, and as follows:

1. Fine aggregate shall consist of sand or crushed stone screenings, clean, hard, free of deleterious matter. Grade by weight to pass sieves as follows:

a. 3/8-inch: 100 percent
b. No. 4: 95-100 percent
c. No. 8: 80-90 percent
d. No. 16: 50-75 percent

e. No. 30: 30-50 percent
f. No. 50: 10-20 percent
g. No. 100: 2-5 percent

2. Coarse aggregate shall consist of gravel or crushed stone, clean, hard, free of deleterious matter. Grade by weight to pass sieves as follows:

a. 1/2-inch: 100 percent
b. 3/8-inch: 30-50 percent
c. No. 4: 0-15 percent
d. No. 8: 0-5 percent

C. Fiber reinforcement shall be Fibermesh® Inforce™ e3™ , or equal, applied at the application rate of 1.5 lbs. per cubic yard of concrete.

2.3 TOPPING MIX

A. Design mix to produce topping material with the following characteristics:

1. Compressive strength shall be 4500 psi at 28 days.

2. Slump shall be 8 inches maximum at point of placement for concrete containing high-range water-reducing admixture (super-plasticizer) and 3 inches maximum for other concrete.

3. Maximum W/C ratio shall be 0.42.

2.4 MIXING

A. Provide batch type mechanical mixer for mixing topping material at Project site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water measuring device. Use only mixers that are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.

B. Mix each batch of 2 cu. yds. or less for at least 1-1/2 minutes after ingredients are in mixer. Increase mixing time 15 seconds for each additional cu. yd. or fraction thereof.

Ready-mixed topping may be used when acceptable to Engineer. When acceptable, furnish ready-mixed topping complying with requirements of ASTM C 94.

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

A. Remove dirt, loose material, oil, grease, paint, or other contaminants from hardened concrete surface leaving a clean surface.

When slab surface is unacceptable for good bonding, roughen surface by chipping or scarifying before cleaning. Prior to placing topping mixture, thoroughly dampen slab surface but do not leave standing water. Over dampened surface apply specified bonding agent. Place topping mix while bonding agent is still tacky.

B. Mark locations of joints in slab so that joints in topping course will be placed directly over them.

3.2 PLACING AND FINISHING

A. Spread topping mixture evenly over prepared base to the required elevation and strike off. Use highway straightedge, bull float, or darby to level surface. After the topping has stiffened sufficiently to permit the operation, and water sheen has disappeared, float the surface at least twice to a uniform sandy texture. Re-straighten where necessary with highway straightedge. The surface shall achieve an F/F of 20 and F/L of 17 tolerance when tested in accordance with ASTM E 1155. Uniformly slope surface to drains.

B. Where joints are required, construct to match and coincide with joints in base slab. Provide other joints as shown.

C. After floating, begin first trowel finish operation using power driven trowels. Continue troweling until surface is ready to receive final troweling. Begin final troweling when a ringing sound is produced as trowel is moved over surface.

D. Continue final trowel operation to produce finished surface free of trowel marks, uniform in texture and appearance, and achieving an F/F of 25 and F/L of 20 tolerance when tested in accordance with ASTM E 1155.

3.3 CURING AND PROTECTION

Cure and protect topping applications and finishes as specified in Section “Cast-In-Place Concrete.”

3.4 PERFORMANCES

Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

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APPENDIX E

SECTION 072710

STAINLESS STEEL SLUDGE PIPING AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for providing stainless steel sludge piping, complete with fittings and accessories. The stainless steel piping and fittings specified below are intended for liquid service and are provided as alternates to the glass lined ductile iron sludge piping and fittings as indicated in accordance with the Contract Documents.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society of Mechanical Engineers (ASME)

2. American Society for Testing and Materials (ASTM)

3. American Welding Society (AWS)

4. Manufacturer's Standardization Society of the Valve and Fitting Industry, Inc. (MSS)

5. American National Standards Institute (ANSI)

1.3 SUBMITTALS

A. Copies of affidavit from manufacturer that all materials furnished have been tested and comply with all applicable provisions of the Standards listed and this specification.

B. Copies of each of the following shop test results shall be submitted:

1. Chemical and physical properties

2. Results of hydrostatic tests, including identification of each spool piece and component.

C. Prior to the start of the work, Contractor shall submit a list of proposed welders and the type of welding for which each has been qualified.

PART 2 MATERIALS

2.1 MANUFACTURERS

A. The following manufacturers are named to establish a standard of quality necessary for the Project:

1. Douglas Brothers Div., Robert Mitchell Co., Inc. Portland, ME
2. Tioga Pipe Supply Company, Inc., Philadelphia, PA
3. Or equal

2.2 STAINLESS STEEL PIPE AND FITTINGS

A. Stainless steel pipe, pickled and passivated, shall be ASTM A778, type 304L, Schedule 10S.

B. Joints for stainless steel pipe and fittings shall be provided as butt welded or flanged. The quantity of field welds shall be minimized and locations of field welds shall be submitted to the Engineer for approval.

C. Fittings shall conform to the following:

1. Butt weld type, stainless steel, pickled and passivated, schedule to match piping, ASTM A774, Type 304L, conforming to MSS SP-43.

2. All elbows shall be long radius, unless otherwise designated.

3. The quantity of field welds shall be minimized and locations of field welds shall be submitted to the Engineer for approval.

D. Stub ends shall be stainless steel, ASTM A240, Type 304L, conforming to MSS-SP43, or flared nipples, schedule to match pipe.

E. Flanged Joints

1. Flanged pipe ends shall be made of type 304L stainless steel slip-on type rolled angle face rings and primed ductile iron backup flanges drilled to ANSI 16.1 Class 125 standard or MSS SP44 or whatever may be required to match field connections, subject to approval by the engineer.

2. The angle face ring thickness shall be equal to or greater than the wall of the pipe or fitting to which it is welded and it shall be continuously welded on both sides to the pipe or fitting.

3. The angle leg shall not interfere with the flange bolt holes.

4. The back-up flanges shall be supplied with the following nominal thicknesses:

Nominal Pipe Size	Flange Thickness
less than 3-inches	1/2 inch
4 inches	9/16 inch
6 - 10 inches	5/8 inch
12 - 16 inches	3/4 inch
18-20 inches	7/8 inch
24-30 inches	1 inch

E. Flanges shall be provided as a minimum at all flanged equipment items. Joints for shipping, handling, and installation shall be flanged or arched band couplings.

F. Bolts and Nuts

1. Unless otherwise specified, bolting shall be Type 304 stainless, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.

2. When mating flange on valves or equipment is cast iron, use ASTM A307, Grade B, square head bolts and ASTM A563, Grade A heavy hex head nuts.

G. Thread lubricant shall be Teflon tape.

H. Covered welding electrodes for shielded metal arc process for Type 304L pipe shall be in accordance with AWS 5.4, E 308L.

I. Welding rod and bare electrodes for gas tungsten arc or gas metal arc processes for Type 304 pipe and Type 304L pipe shall be in accordance with AWS 5.9, ER 308 and AWS5.9, ER 308L, respectively.

J. Suitable dielectric insulation shall be provided to isolate dissimilar metals when applicable.

K. Gaskets shall be 1/8-inch thick neoprene rubber, durometer hardness of No. 80, 1500 psi minimum tensile strength, 125 percent minimum elongation, flat ring type with RF flanges and full face type with FF flanges, Garlock Style 7797, or equal.

L. Pipe anchors shall be placed where shown on the Drawings.

M. Threaded connections shall be provided as needed for instrumentation. The Contractor shall coordinate with the pipe manufacturer the quantities, sizes and locations of threaded connections, as indicated in the Contract drawings and specifications.

2.3 SOURCE QUALITY CONTROL

A. Welding Procedure Qualification

1. Furnish Engineer for prior review, procedure specifications and qualification records of welding procedures for all pipe welding to be performed under this Section, in accordance with AWS Standards.

B. Shop Testing shall include the following:

1. Chemical and physical properties.

2. Hydrostatic test of all components, spool pieces, etc. to 125 psig.

PART 3 EXECUTION

3.1 FABRICATION AND INSTALLATION

A. All fabrication and welding shall be performed in the shop by certified welders to ASME approved procedures and AWS Standards. Field welding shall be permitted only as approved by Engineer. All welding shall be by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide a cross-section of weld metal equal to, or greater than, the parent metal. Inert gas shielding shall be provided to the interior and exterior of the joint. Interior weld beads shall be smooth, even, and not have an interior projection more than 1/16 inch beyond the I.D. of the pipe or fitting.

B. Spools shall be fabricated to the "Pipe Fabrication Institute" fabricating tolerances ES-3 (1981).

C. After welding, all welded joints shall be cleaned with an industry standard cleaning solution, brushed with stainless wire brushes, and rinsed clean.

D. All fabricated piping shall have openings plugged and flanges secured for storage and/or transport after fabrication. All fabricated piping shall be piece marked with identifying numbers or codes which correspond to the contractor's layout and installation drawings. The marks shall be located on the spools at opposite ends and 180 degrees apart.

E. The piping supplier during manufacturing, fabrication, and handling stages, and the contractor during handling and installation stages, shall use extreme care to avoid the contact of any ferrous materials with the stainless steel piping. All saws, drills, files, wire brushes, etc., shall be used for stainless steel piping only. Pipe storage and fabrication racks shall be non-ferrous or stainless steel or rubber lined. Nylon slings or straps shall be used for handling stainless steel piping. Contact with ferrous items may cause rusting of iron particles embedded in the piping walls. After installation, the contractor shall wash and rinse all foreign matter from the piping surface. If rusting of embedded iron occurs, the contractor shall pickle the affected surface with Oakite Deoxidizer SS or equal, scrub with stainless steel brushes, and rinse clean.

3.3 FIELD TESTING

A. All sections of pipelines shall be cleaned and flushed prior to testing.

B. All pipelines shall be hydrostatically tested in accordance with Section 02602 – Leakage Tests – Non-structural. Test pressure and duration shall be as specified in Section 02602, unless more stringent requirements are requested by the Engineer.

C. No leakage will be allowed during the test.

D. The equipment required for testing shall be furnished by the Contractor and shall include the necessary compressor, valves and gauges to allow for the monitoring of the pressure, release of pressure and a separable test gauge.

3.4 PAINTING

A. After installation, paint all steel or iron flanges, couplings, and appurtenances per requirements of the Section entitled "Field Painting".

B. Painting of stainless steel pipe is not required. However, stainless steel piping shall be supplied and installed with a consistently clean surface. Identifying spool piece marks shall be removed with paint thinner or solvents.

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APPENDIX F

SECTION 15051

BASIC PROCESS MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for basic mechanical materials and methods for process mechanical systems. It applies to all Sections of Division 11 and 15 and to other Sections that include mechanical equipment requirements except when other requirements are specified. Process Mechanical systems shall be complete including all miscellaneous materials, and ready for operation as indicated in accordance with the Contract Documents.

B. Refer to the Section entitled “Basic Mechanical” for basic mechanical materials and methods for HVAC, plumbing, and potable water systems.

1.2 QUALITY ASSURANCE

A. Unless otherwise indicated, materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment shall be provided. The manufacturer's latest standard design that conforms to these Specifications shall be provided. When two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer.

B. Welding shall be performed by certified welders in accordance with the requirements of AWS D1.1 for the types of welding required on the Work.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. Structural members shall be designed for appropriate shock and vibratory loads.

D. Materials and workmanship shall conform to the requirements of the latest editions of the following codes, regulations and specifications:

NFPA	AGA	
UL	ARI	
ASME		ANSI
AGMA	AWS	
AMCA	AISC	
AFBMA		

In addition, materials and workmanship shall conform to applicable local codes, regulations and ordinances. Adherence to the referenced codes and regulations shall constitute minimum requirements for the mechanical work. If a conflict arises between the codes and the Contract Documents, the more stringent requirements shall apply unless otherwise approved by the Engineer.

1.3 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:

1. Scaled mechanical layout working drawings showing dimensioned plan views and elevations of mechanical equipment; equipment mounting and foundations; and components including space conditions, coordination with building features and other work.

B. Submit certificates of compliance for eight-inch and smaller diameter pipes and fittings.

C. Submit manufacturer's certificates for material.

1.4 DELIVERY, STORAGE AND HANDLING

A. Materials and equipment shall be protected from exposure to the elements and shall be kept dry at all times. Items shall be handled and stored to prevent damage and in accordance with manufacturer's recommendation.

C. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer, at no expense to the Owner.

1.5 JOB CONDITIONS

A. The Contract Drawings indicate the extent and general arrangement of equipment and, piping. Equipment shall fit in the space allotted and allow adequate clearance for entry, installation, replacement, servicing and maintenance. Actual and final arrangement, location, grades and elevations of equipment, appurtenances, piping and ducts shall be verified by the Contractor before ordering material and equipment. If departures are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer for approval as soon as practicable but not later than submittal of scaled mechanical shop drawings. No departure shall be made without the Owner's written approval.

B. The Work shall be coordinated so equipment may be moved in place without altering building components, other equipment or installations. Drops, rises or offsets not shown on the Contract Drawings but required for proper installation of the work shall be provided.

1.6 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears and other rotating parts shall be enclosed or properly guarded so personnel may safely be in close proximity thereto.

B. Items such as catwalks, ladders and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.7 SEQUENCING AND SCHEDULING

A. Sequencing and scheduling of mechanical work shall be coordinated with the building construction and other related parts of the Work including verification that all structures, piping, wiring, conduits and equipment components are compatible.

PART 2 PRODUCTS

2.1 GENERAL

A. In the design and supply of pipework, interchangeability of parts and items for equipment, piping, ductwork, motors and other appurtenances shall be provided.

2.2 EQUIPMENT BASES

A. Equipment shall be provided with concrete bases a minimum of three and one-half to five and one-half inches high, unless otherwise indicated.

B. Cast iron or welded steel baseplates shall be provided. Each unit and its drive assembly shall be supported on a single baseplate.

2.3 ANCHOR BOLTS

A. Anchor bolts shall meet the requirements of the Section entitled “Metal Fabrications”.

B. Where cast-in-place anchor bolts are required, the Contractor shall provide anchor bolts together with template or setting drawing sufficiently in advance to permit anchor bolts to be set when structural concrete is being placed.

2.4 SUPPORTS AND BRACES

A. Supports and braces fabricated shall be provided to meet requirements of the Section entitled “Metal Fabrications”.

2.7 SHOP PAINTING

A. Equipment, supports, piping, ductwork and appurtenances shall be surface prepared and shop coated as specified in the individual Sections including Section entitled “Painting” and as shown on the Contract Drawings except at connecting ends and where it hinders installation. These points shall be primed and field painted after installation. Shop primer shall be compatible with required field coat.

PART 3 EXECUTION

3.1 PREPARATION

A. Locations, areas and surfaces to receive mechanical equipment, piping, duct work and appurtenances shall be inspected to verify that areas are ready for installation. Before installation, defects and damaged areas shall be repaired, and surfaces and areas shall be adjusted so they are ready for proper installation.

B. Areas to be occupied by mechanical equipment and appurtenances shall be measured to verify that space is adequate and in accordance with approved Shop Drawings. If adjustment is required, approval from the Engineer shall be obtained to adjust any locations and equipment as approved.

3.2 INSTALLATION

A. Equipment and appurtenances shall be installed in accordance with manufacturer's instructions. The Contractor shall provide complete final connections to equipment, including pipe, duct, electric and controls.

B. Whether shown or not, isolation valves and accessory fittings shall be provided on each side of equipment to allow the equipment to be removed and isolated for servicing. High points in piping shall be provided with manual vents and low points in fluid piping provided with drain valves fitted for hose adapters. Rises and drops as required by field conditions, whether shown or not, shall be provided. The above required items shall be provided by the Contractor at no additional cost to the Owner.

C. Installation of mechanical systems, components and materials shall be coordinated with other portions of the work, including electrical wiring and conduit systems, structural supports and concrete work, and architectural work.

3.3 FOUNDATIONS, BASES AND SUPPORTS

A. Equipment, ductwork, electrical conduits and piping shall be supported by providing compatible frames, braces, hangers and anchors.

B. Unless otherwise shown on the Contract Drawings, floor mounted equipment shall be set on reinforced concrete pads a minimum of three and one-half to five and one-half inches high, doweled to the floor. Equipment pads and anchors shall be placed and set simultaneous with the floor. Baseplate, anchor bolts and vibratory absorption pad construction shall be provided as recommended by the equipment manufacturer. Baseplate shall be anchored to the concrete base with anchor bolts, leveled using shims or wedges, and the space beneath filled with quick setting non-shrink grout. After grout has hardened, anchor bolts shall be finally tightened and cut off not more than one inch nor less than 1/2 inch above top of nut. Leveling nuts under equipment bases shall not be used.

C. Equipment suspended inside buildings shall be braced and supported to provide a rigid installation. Supports and hangers shall be attached to bearing walls, roof and floor supports, or framing members. Cross bracing shall be provided, as required, to develop a rigid installation.

3.4 ACCESS PANELS

A. The Contractor shall provide access panels and openings where it will be necessary for maintenance and servicing of concealed equipment, piping and ductwork.

3.5 ADJUSTMENT AND INITIAL OPERATION OF EQUIPMENT

A. Before systems and equipment are initially started, piping, ductwork and equipment shall be cleaned. Moving parts shall be checked for freedom of movement, alignment and adjustment.

3.6 SURFACE TOUCH-UP/FIELD PAINTING

A. The Contractor shall touch-up surfaces where shop coats have been damaged using paint, coatings and film thickness identical to original shop coats.

B. The Contractor shall clean field installed bolts, nuts, washers and support systems. Items shall be painted or coated identical to original shop coat and/or surrounding area.

3.7 PROTECT AND CLEAN

A. Equipment shall be protected during and after installation from construction dust and debris. Temporary protection shall be provided as required until equipment is in operation or receipt of Certificate of Substantial Completion.

B. The Contractor shall clean equipment, surrounding area and ductwork inside and out.

3.8 FIELD QUALITY CONTROL

The Contractor shall demonstrate inspection and test the operation of the various systems and equipment in the presence of the Engineer as specified in the individual Sections for the equipment.

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APPENDIX G

SECTION 15061

PROCESS MECHANICAL HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for providing hangers and supports complete with all accessories as indicated in accordance with the Contract Documents for process mechanical equipment (piping and equipment shown on the mechanical drawings).

B. Refer to Section entitled "Hangers, Supports, and Restraints" for hangers, supports and restraints for mechanical systems including HVAC, plumbing, and potable water systems.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American National Standards Institute (ANSI)

2. American Society of Mechanical Engineers (ASME)

a. B31.1, Pressure Piping

3. American Society for Testing and Materials (ASTM)

4. American Standards Association, Inc. (ASA)

5. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

a. SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture

b. SP-69, Pipe Hangers and Supports – Selection and Application

c. SP-90, Guidelines on Terminology for Pipe Hangers and Supports

1.3 SYSTEM DESCRIPTION

A. General

1. Pipe hangers and supports include all metallic hanging and supporting devices and all concrete piers for above-ground or interior pipeline conduits and fittings, except electrical conduits.

2. Hangers and supports for electrical work are specified in the Section entitled "Conduits".

1.4 SUBMITTALS

A. Provide submittals in accordance with the General Provisions, including the following items:

1. Catalog data for supports, fasteners, inserts and anchors.

2. Shop drawings for the following:

a. Details of intermediate structural steel members required to span main structural steel for support of piping, equipment, and ductwork.

b. Details of methods for attachment of hangers and supports to building construction for equipment and piping 4 inches and larger.

c. Details of guide and anchor installations.

d. Details of trapeze hangers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All equipment furnished under this Section shall be furnished by manufacturers who meet the quality, workmanship, and experience requirements as specified in the General Provisions Section of this contract.

B. The following manufacturers are named to establish a standard of quality necessary for the Project:

1. Anvil International, Inc. (formerly Grinnell Company)
2. Or equal

2.2 GENERAL

A. Hangers and supports shall be adequate to maintain the supported load in proper position under all operating conditions.

B. Factor of Safety

1. Hangers and supporting devices shall be designed to provide a minimum working safety factor of 3.5.

2. The safety factor for pipe hangers and supports shall be based on supporting pipe filled with water.

C. Hangers and Supports for Hazardous Chemical Piping (seismic design)

1. The contractor shall design and install supports for all alum, acetic acid, sodium hypochlorite, and calcium hypochlorite piping to resist seismic forces. These chemicals are classified as Hazardous Chemicals per IBC 2003.

2. Refer to the structural drawings for project design criteria. The facility is classified as Seismic Design Category C. The hangers and supports for hazardous chemical piping shall be given a component importance factor of 1.5. All requirements of the latest version of the Virginia Uniform Statewide Building Code and International Building Code shall be utilized for seismic design.

2.3 MATERIALS AND CONSTRUCTION

A. Hangers and Supports for Corrosive Areas

1. Hangers, supports, and struts located in corrosive areas shall be Type 304 stainless steel with stainless steel hardware.

2. Corrosive areas shall include the interior and exterior of the Headworks structure, the existing Pretreatment Building Grit System Room, the First Floor of the Sludge Conditioning Building, and the Lime Stabilization Area.

3. Refer to "Hangers and Supports for non-corrosive Indoor Areas" below for general requirements.

B. Hangers and Supports for non-corrosive Outdoor Areas

1. Unless specified as stainless steel elsewhere, hangers, supports, and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot-dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor use.

2. Refer to "Hangers and Supports for non-corrosive Indoor Areas" below for general requirements.

C. Hangers and Supports for non-corrosive Indoor Areas

1. Pipe

Pipe for supports shall be in accordance with the following standards:

a. Wrought Steel Pipe - ASTM Des: A 53 Schedule 40
b. Cast Iron Pipe - ASA Des: 21.6 and 21.8, Thickness Class 22

2. Pipe and Castings

Structural steel, wrought metals and metal castings used for hangers and supports shall meet the requirements of the applicable Sections.

3. Hangers

a. Overhead hangers for pipes eight inches in diameter and smaller shall be supported by threaded rods and shall be Split Ring Type.

b. Overhead hangers for pipes 10 inches in diameter and larger, and for smaller pipes where shown or specified, shall be single rolls and sockets.

c. Ceiling flanges shall be utilized for pipes 8 inches or less. Concrete rod attachment plates shall be utilized for pipes larger than 8 inches.

4. Supports

a. Brackets for supporting piping from walls or columns shall be furnished with back plates where required to prevent the safe bearing capacity of the wall from being exceeded.

b. Saddle stands shall be of the adjustable type, with floor flanges for bolting to floors or foundations.

c. Where piping is installed on structural steel supports, blocking or pipe rolls shall be provided to prevent lateral pipe movement.

d. Insulated pipes 2-1/2 inches in diameter and larger shall be provided with protection saddles as requested or specified.

e. Beam and channel clamps shall be of malleable iron.

f. Channel sections shall be complete with clamping nuts and fittings. Channel sections systems for piping supports systems shall be Series PS-200 Power Strut or equal. Finish for channel sections and fittings shall be hot dipped galvanized conforming to ASTM A153. All exposed channel ends shall be provided with end caps.

g. Concrete pier supports shall be of Class "B" (4000 psi) concrete. 60 durometer rubber shall be placed between concrete and pipe.

h. Pipe sections continuously supported by channel iron shall be as follows:

For PVC Pipe:

Pipe Size (inches)	Maximum Hanger Spacing (feet)	Size of Channel Iron (inches)
2"	10	2
3"	10	3
4"	10	4

i. Clamps for supporting piping (3/8" to 4") from walls shall be malleable iron.

5. Inserts

   a. Inserts for concrete shall be hot dipped galvanized and shall be installed in concrete structures where required and where shown on Contract Drawings.

   b. Continuous inserts shall be PS-349 by Power Strut or equal.

   c. Spot inserts shall be Power Strut G-152 or equal.

   d. All concrete inserts shall have plastic coated filler to prevent concrete seepage.

6. Hanger Rods

   a. Hanger rods for installation in wet areas shall be continuously threaded, Type 316 stainless steel. Hanger rods for installation in other areas shall be continuously threaded, hot dip galvanized steel unless otherwise indicated.

   b. The minimum acceptable size hanger rod for each installation shall be determined from the following table:

Size of Pipe-Inches	Diameter of Rod-Inches
Up to 2	3/8
2-1/2 to 3-1/2	1/2
4 and 5	5/8
6 and 8	3/4
10 and 12	7/8
14 and 16	1
18 to 30	1-1/4
36 to 42	1-1/2
42 to 48	1-3/4

   c. Hanger rods shall be provided with two removable nuts each end, of like material (Type 316 stainless steel or hot dip galvanized as required), for positioning and locking rod in place.

7. Anchor Bolts

   a. Provide stainless steel anchor bolts, nuts and washers, type 316, meeting requirements of the Section entitled "Metal Fabrications" and as indicated on the Drawings. Unless otherwise indicated, size anchor bolts to the largest diameter that will pass through the bolt holes of the equipment base. Length of the bolts shall be long enough to permit a minimum of one inch of grout beneath the base plate and a minimum of three inches anchorage into the structural concrete.

   b. Provide anchor bolts, nuts and washers together with template or setting drawing sufficiently in advance to permit anchor bolts to be set either prior to or during structural concrete placement.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be performed as recommended by the manufacturer and shall be such that the centerline elevations of supported piping are maintained in an orderly manner.

B. Pipe Hangers and Supports

1. Horizontal metal pipe shall be supported in accordance with the following schedule:

Pipe Size	Maximum Hanger Spacing
1/2 to 1-1/4 inch	6'-0"
1-1/2 to 2 inch	10'-0"
2-1/2 to 3 inch	10'-0"
4 to 6 inch	15'-0"
over 6 inch	17'-0"

2. Horizontal plastic pipe shall be supported in accordance with the following schedule:

Pipe Size	Maximum Hanger Spacing
1/2 to 1-1/4 inch	4'-0"
1-1/2 to 2 inch	5'-0"
2-1/2 to 3 inch	6'-0"
over 4 inch	6'-6"

1. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

2. Install a hanger within 12 inches of each horizontal elbow.

3. Use hangers with 1-1/2 inch minimum vertical adjustment.

4. Support horizontal cast iron pipe adjacent to each hub, with five feet maximum spacing between hangers.

5. Support vertical piping at every floor.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Support riser piping independently of connected horizontal piping.

8. Unless otherwise shown, specified or directed, no piping shall be supported from other piping, or from stairs, ladders or walkways.

9. Hangers and supports shall be installed such that piping live and dead loads and

stresses from movement do not transmit to connected equipment.

C. Inserts

1. Concrete inserts shall have plastic coated filler to prevent concrete seepage.

2. Inserts shall be provided for suspending hanger rods and hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Where concrete slabs form finished ceiling inserts shall be provided flush with slab surface.

D. Where pipe is insulated, provide insulation shields and high-density insulation inserts.

E. Upper Hanger Attachments

1. Upper hanger attachments shall be made to structural steel wherever possible.

2. Power driven pins shall not be used.

3. Expansion nails shall not be used.

4. Powder driven fasteners shall not be used in pre-cast concrete.

5. Loads in excess of 250 pounds shall not be supported from a single welded or powder-driven stud.

F. Steel Frame Construction

1. Provide intermediate structural steel members where required by ductwork support spacing.

2. Secure upper hanger attachments to steel bar joists at panel points.

3. Holes shall not be drilled in structural steel members.

4. Friction clamps shall not be used.

3.2 PAINTING

A. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and coated with rust-inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.

B. Perform field painting in accordance with the Section entitled "Painting".

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APPENDIX H

SECTION 15992

PIPE PRESSURE TESTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe pressure tests for building services piping systems as scheduled in Part 3 of this section.

B. Refer to Section entitled "Leakage Test – Non Structural" for yard piping testing.

1.2 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:

B. Test Reports

1. A separate test report shall be submitted for each pressure test performed.

2. Information presented in test reports shall be typewritten, clear, concise, and accurate.

3. Reports shall be signed and dated by the supervisor in charge of performing the test and designated Inspector. Signatures shall certify that all information contained in the report is true and accurate to the best of the signatory's knowledge.

4. Reports shall contain, as a minimum, the following information:

   a. Type of test performed (e.g., hydrostatic, pneumatic, Freon, etc.)
   b. Description of system, or portion of system to which testing was performed.
   c. Date of test.
   d. Time of pressure start.
   e. Time of pressure test completion.
   f. Test fluid used in test (e.g., tap water, dry air, Freon, etc).
   g. Pressure reading at beginning of test.
   h. Pressure reading at end of test.
   i. Location of pressure indicating devices.
   j. Precise location of leaks detected.
   k. Summary of leaks detected and suggested corrective action.
   l. Conclusions regarding overall fitness and condition of tested system.
   m. Signatures as described above.
   n. Appendix: Calibration history of instruments used.

1.3 REFERENCES

A. Perform pressure tests on piping scheduled below in accordance with International Plumbing Code requirements as applicable.

1.4 QUALITY ASSURANCE

A. Tester's Qualifications

1. Workers and their supervisors performing the Work of this section shall be personally experienced in testing of pipe systems and shall have been regularly employed by a company with three years minimum experience in testing of similar pipe systems.

B. Inspection

1. Tests shall be performed by the Contractor in the presence of designated Inspector(s). Witness and signoff is required.

2. Inspectors shall, at all times, have access to any place where work is in preparation or in progress and Contractor shall provide sufficient safe and proper facilities for such access and inspection.

1.5 SCHEDULING AND SEQUENCING

A. Perform test operations on complete piping system or in sections as required and/or directed to progress Work in satisfactory manner and not delay the general construction of the project.

B. If testing is performed in sections, valve or cap-off sections of piping to be tested, utilizing valves to be installed in permanent piping systems or temporary valves or caps as required to perform tests.

C. Transmit written notification of proposed date and time of pressure tests to the Owner's Representative at least 5 days in advance of such tests.

D. Pressure tests shall be performed prior to the installation of piping insulation or coverings.

E. Pressure tests on underground piping shall be performed when piping has been partially backfilled with joints exposed.

F. Pressure tests shall be performed prior to initial operation of piping systems.

PART 2 PRODUCT

2.1 TEST MATERIALS

A. Test Fluid: Where scheduled, test media shall meet the following criteria.

1. NPW/Utility/Plant Water: Plant Effluent

2. Drinking Water: Treated, chlorinated potable water.

3. Air: Filtered, oil-free, dry compressed air supplied at or above indicated test pressure.

2.2 TEST EQUIPMENT

A. Gauges: Calibrated, dial-type, suitable for use with specified test fluid. Upper limit of gauge pressure range shall be 1.33 times the specified test pressure. Gauge accuracy shall be 1 percent of the indicated reading or better.

B. Soap Solution: American Gas & Chemical, “Leak-Tec”; or equivalent.

C. Air Compressor: Unit rated to supply compressed air at or above required test pressure. Unit shall have necessary filters and driers to deliver clean, oil-free, dry compressed air. Unit shall have shut-off valve installed on discharge connection.

D. Pressure Relief Valve: Suitable for use with compressed air, set to relieve at 10 to 15 percent above designated test pressure.

PART 3 EXECUTION

3.1 GENERAL

A. Tests shall be conducted at ambient temperature, unless otherwise specified.

B. Do not use permanent system pressure gauges for pressure testing; remove and plug or isolate such gauges from the system during pressure tests.

C. Instrumentation in, or attached to, the piping being tested shall be protected during testing by isolation or removal. Return instrumentation to pre-test condition after completion of pressure testing.

D. Piping connected to specialties or equipment with a lower pressure rating than the specified test pressure shall be disconnected from the equipment (after the isolation valve) and openings plugged during the pressure test. After the completion of pressure testing, the piping shall be reconnected to the equipment.

E. Expansion joints shall be provided with temporary restraint or blocked off during testing.

F. Pressurization of piping systems by liquids or gases shall be executed in a slow and prudent manner to maintain safety, avoid over-pressurization, and avoid excessive leakage.

G. Piping systems designed for gases that are tested with a liquid may require additional temporary support during tests to support the weight of the liquid. Provide extra support as required.

H. If the piping fails the test requirements, the Contractor shall determine the cause of leakage, make necessary repairs, and retest the piping. This procedure shall be repeated until the piping complies with test requirements. A separate test report shall be submitted for each test to a piping system or section of piping.

I. No caulking or putty shall be used in the repair of leaks. Back-welding of threaded joints shall not be permitted as a means of repairing leaks.

J. Test reports shall be filled out and readings recorded as testing proceeds.

K. Safety glasses and hard hats shall be worn by personnel involved in or witnessing tests conducted at pressure of 20 psig or greater.

3.2 EXAMINATION

A. Examine equipment and construction in the area of piping to be tested. Note equipment and existing construction that may be damaged by leakage of the test fluid.

B. Verify that piping system bracing, alignment harnesses, and thrust restraints are in place before pressure is applied. Concrete restraints shall have cured adequately to withstand test pressure.

3.3 PREPARATION

A. Protect equipment and construction which may be damaged by leakage of test fluid by covering with appropriate material or removing from area.

B. Verify that piping to be tested is clean and all outlets in the system are closed.

C. Open non-outlet valves in piping section to be tested. Check valves that can prevent system sections from being filled or pressurized shall have their discs, etc. removed for testing (restore check valves to their pre-test) condition after completion of pressure testing).

D. Evacuate test areas of personnel not involved in the pressure testing.

3.4 HYDROSTATIC PRESSURE TEST

A. Install pressure gauge to measure system pressure at low point in system.

B. Connect pressurization pump to system.

C. Fill the system with test liquid, opening vents to permit complete filling. Close vents.

D. Using the pump, raise the pressure in the system to the scheduled test pressure. Hold pressure for a minimum of 1 hour.

E. Reduce and hold the pressure 20 percent below test pressure. Inspect the entire system for visible leaks. Note location of leaks for repair.

F. If leaks or defects are found, release the pressure, drain the system, and make repairs. Repair the test procedure on the repaired piping.

G. If the piping shows no visible leakage, raise the pressure in the system to the scheduled test pressure and isolate the system, under pressure, from the pump. the system should be closed with the pressure gauge indicating test pressure within system.

H. System shall remain pressurized for the duration indicated in the test schedule. After the specified duration, check pressure reading on system gauge. No detectable drop in pressure shall have occurred in the system.

I. If a drop in pressure occurs, Contractor shall determine cause. Once cause is determined release the pressure, drain the system, repair pipe as necessary, and retest.

J. Upon compliance with test requirements, drain the system, remove items added or replace those removed for testing.

3.5 PNEUMATIC PRESSURE TEST

A. UNDER NO CIRCUMSTANCES SHALL PNEUMATIC TESTING BE PERFORMED ON NON-METALLIC PIPE.

B. Install pressure gauge to measure system pressure.

C. Connect air supply to piping system.

D. Open inlet valve and allow pressure to increase slowly to 25 psig or 20 percent of scheduled test pressure, whichever is LESS.

E. Close inlet valve and monitor system pressure for the duration indicated in the test schedule. Checking for any drop in pressure that would indicate leaks.

F. If leaks are detected, locate leaks and judge the safety of bringing the system to the full test pressure. If judged unsafe, relieve the pressure on the system, repair leaks, and retest system at low pressure before proceeding.

G. Increase pressure to the specified test pressure. Close inlet valve and monitor system pressure for duration specified in schedule. After the specified duration, check pressure reading on system gauge. No detectable drop in pressure shall have occurred in the system.

H. If a drop in pressure occurs, Contractor shall check all joints and other possible sources of leaks with soap solution. Once cause is determined release the pressure, repair pipe as necessary, and retest.

I. Upon compliance with test requirements, vent and allow system to return to atmospheric pressure. Remove items added or replace those removed for testing.

3.6 GRAVITY TEST

A. Perform test before fixtures are installed.

B. Test by filling system with free standing (i.e., open to atmosphere) test fluid. Note level of fluid at free surface at beginning of test.

C. Test joints under a minimum standing head as scheduled (see Test Pressure in Schedule), except for upper sections of piping. Test upper sections of piping to overflowing.

D. Allow test fluid to stand in system for duration scheduled. There shall be no noticeable loss of fluid during the specified duration.

E. If leaks are detected or if drop in fluid level occurs during specified duration, drain the system, repair pipe as necessary, and retest.

F. Upon compliance with test requirements, drain system, remove items added or replace those removed for testing.

3.7 PIPE TEST SCHEDULE

A. Perform pressure tests, of type indicated, on piping system(s) indicated using scheduled test fluid and pressure.

B. Schedule

UTILITY	TEST METHOD	TEST MEDIUM	TEST PRESSURE	TEST DURATION	LEAKAGE
Domestic and Potable Water	Hydrostatic	Water	100 psig	1 Hour	0
Utility Water	Hydrostatic	Water	150 psig	1 Hour	0
Deionized Water	Hydrostatic	Water	75 psig	1 hour	0
Sanitary Drainage & Vent	Gravity	Water	10 ft. of water	3 hours	0
Process Drainage	Gravity	Water	10 ft. of water	3 hours	0
Compressed Air	Per Specification Section	---	---	---	---
Fire Protection	Per Specification Section	---	---	---	---
Sump Pump Discharge	Hydrostatic	Water	100 psi	1 hour	0
Wastewater, Scum	Hydrostatic	Water	50 psi	1 hour	0
Sludge	Hydrostatic	Water	100 psi	1 hour	0
Chemicals	Hydrostatic	Water	100 psi	1 hour	0

*Note – for fully metallic piping systems, pneumatic testing may be performed in lieu of hydrostatic testing where deemed acceptable by the Engineer. The Contractor must submit a request to perform pneumatic testing, with specific locations identified, to the Engineer for approval prior to testing.

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