CITY OF TULSA

WATER AND SEWER
Engineering Design

DATE:
July 1, 2026

TO:
Plan Holders
Contractors

FROM:
Jenna Richardson
918-596-9637
jennarichardson@cityoftulsa.org

EMAIL TRANSMITTAL

ADDENDUM NO. 1

1836 × 1898

PROJECT NO. TMUA-W 24-03 Mohawk WTP Chemical Tank Replacement

TUL × USA

Number of pages: 58

All addenda to the contract documents should be denoted on the last page of the Proposal in the space provided.

Thank you,
Contract Administration

CITY OF TULSA

WATER AND SEWER
Engineering Design

DATE:
July 1, 2026

ADDENDUM NO. 1
TO
PROJECT NO. TMUA-W 24-03 Mohawk WTP Chemical Tank Replacement

This Addendum No. 1 consisting of fourteen (14) clarifications and nine (9) items, submitted by Garver, and one (1) item by the City of Tulsa, is hereby made a part of the Contract Documents to the same extent as though it were originally included therein and shall supersede anything contained in the Plans and Specifications with which it might conflict. **All addenda to the contract documents should be denoted on the last page of the Proposal in the space provided.**

This Addendum No. 1 consists of the following:

1.The attached documents list the detailed items that have been modified in Addendum No. 1. These documents shall be inclusive and apply to this project.

2. **Replace** Page C2 of the contract pages with the attached **Contract Page C2**.

All other provisions of the Plans and Specifications shall remain in full force and effect.

CITY OF TULSA

FOR Eric Lee
Director

HAS/TGP/CW/JR/kt

ARTICLE II. That the Authority shall pay to the Contractor for performance of the work embraced in this Contract, and the Contractor will accept as full compensation therefor, the sum (subject to adjustment as provided by the Contract) of AND /100 Dollars ($_____) for all work covered by and included in the Contract award and designated in the foregoing Article I; payments therefore to be made in cash or its equivalent, in the manner provided in the General Conditions.

ARTICLE IIA. All materials and supplies to be purchased under the terms of this contract shall be ordered by the Contractor from the vendor or supplier who shall be directed to invoice the Tulsa Metropolitan Utility Authority direct. The invoice shall reflect any contractor discount and no sales tax shall be added. The invoice will be paid direct by the Tulsa Metropolitan Utility Authority in accordance with the terms and conditions of the invoice (Oklahoma Tax Commission Rules Part 27 Trust Authority 710:65-13-140). The monies paid direct by Tulsa Metropolitan Utility Authority to the vendor or supplier shall be deducted from the total contract price. The Contractor shall accept delivery and be responsible for and shall warrant and hold the Authority harmless for the safety and security of all of the materials and supplies furnished for the project under this contract.

ARTICLE III. That the Contractor shall start work within ten (10) days following the date stipulated in a written order from the Authority to proceed with the work to be performed hereunder, and shall complete the work within the number of consecutive calendar days after the authorized starting date, as stipulated below:

All Work Completed: **546** calendar days

ARTICLE IV. The sworn, notarized statement below shall be signed and notarized before this Contract will become effective.

ARTICLE V. Prior to submitting a final payment request, the Contractor shall furnish a lien waiver certifying that all subcontractors and suppliers have been paid.

ARTICLE VI. If the Contractor has 10 or more full-time employees, and this contract exceeds $100,000 in total value, Contractor acknowledges and agrees that, in accordance with and pursuant to 21 O.S. 1289.31, Contractor verifies to Authority that: (i) it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, and (ii) will not discriminate against a firearm entity or firearm trade association during the term of this Contract.

IN WITNESS WHEREOF, the Authority and the Contractor hereto have set their hands and seals, respectively, this _____ day of _____, 2026.

6100 S Yale Ave. Suite 1300
Tulsa, OK 74136

TEL 918.250.5922

www.GarverUSA.com

July 1, 2024

ADDENDUM NO. 1
TO
PROJECT NO. W 24-03
MOHAWK WTP CHEMICAL TANK REPLACMENT

This Addendum No. 1 consisting of Nine (9) items and fourteen (14) clarifications submitted by City of Tulsa, is hereby made a part of the Contract Documents to the same extent as though it were originally included therein, and shall supersede anything contained in the Plans and Specifications with which it might conflict. **This Addendum shall be attached to the Index Sheet of the Contract Documents and submitted with the bid. Failure to do so shall result in the bid being deemed non-responsive.**

NOTICE TO BIDDERS

1. Bid Opening Date changing from July 10, 2026, to July 17, 2026.

BID PROPOSAL

1. Delete the existing bid proposal form in its entirety and replace with the revised Bid Proposal.

SPECIFICATIONS

1. Remove and replace specification 01 14 00 – Work Restriction.
2. Remove and replace specification 01 20 00 – Price and Payment Procedures.
3. Remove and replace specification 02 41 00 – Demolition.
4. Remove and replace specification 40 61 13 – Process Control System General Provisions.
5. Remove and replace specification 43 42 56 – Sealless Magnetic Drive Centrifugal Pumps.
6. Remove and replace specification 43 41 45 – FRP Tanks
7. Specification 01 50 00 – Temporary Facilities and Controls: Replace paragraph 1.34.7 in its entirety with the following:

   " A temporary chemical transfer pump will be required to fill the hydrofluorosilicic acid day tank from IBC totes. The minimum pump rate should be 30 gpm. Contractor is responsible for providing disconnect with an ON/OFF switch and routing power to the pump."

DRAWINGS

1. Remove and replace Plan Drawing 01-G003.

All other provisions of the Plans and Specifications shall remain in full force and effect.

Digitally Signed 07/01/2026

By: _____

Steven Schultz, P.E.
Project Manager

Bidders Questions and Answers

Bidder Questions and Answers attached. Bidders questions and answers are not considered part of the contract documents and are provided for clarification only.

END OF ADDENDUM NO. 1

ELECTRONIC BID PROPOSAL INSTRUCTIONS - EXCEL SPREADSHEET

PROJECT NO. TMUA-W 24-03

Please read the following instructions carefully.

1. After opening this file re-save it as your company's name.
2. Open the BID FORM Sheet from the tabs below.
3. Input the unit price of the appropriate pay item in the cells highlighted in blue.
4. Review all data input and check calculations to ensure accuracy of Bid.
5. Print 1 hardcopy of the "PROPOSAL" tab, BID FORM and the "SIGNATURE PAGE" tab.
6. Complete and sign the "Signature Page" document.
6. Submit hardcopy and electronic disk with Contract Documents and Specifications for Bid opening date.

LEGEND

$	1.00	Cells Requiring Data Input.
$	1.00	Internal Data Transfer.
$	2.00	Calculated Results.

AGREEMENT FOR USING ELECTRONIC BID PROPOSAL

By and Between: Garver, LLC (ENGINEER) and RECIPIENT. The enclosed electronic media is provided pursuant to your request and is for your limited use in connection with your submittal of Bid Proposal for Project No. TMUA-W 24-03 . In no event shall the information be used for any other purpose or be released to third parties without the written consent of the ENGINEER. In the event of a discrepancy between the hard copy and this electronic media at delivery or in the future, the hard copy shall govern. ENGINEER hereby disclaims any and all liability for the consequences from use of the electronic media and makes no warranty or guarantee of accuracy. RECIPIENT shall assume full responsibility for the uses and consequences of the electronic media. It is agreed that ENGINEER has and retains ownership of the electronic media. ENGINEER does not warrant or guarantee that the electronic data is compatible with RECIPIENT'S computer hardware or software, and ENGINEER'S responsibility for the electronic media is limited to replacement of defective media for a period of thirty (30) days after delivery to RECIPIENT. !!! By opening and using this FILE, You AGREE to these TERMS AND CONDITIONS!!!

PROPOSAL
PROJECT NO: TMUA-W 24-03

TO: TULSA METROPOLITAN UTILITY AUTHORITY
CITY OF TULSA, OKLAHOMA

THE UNDERSIGNED BIDDER, having carefully examined the drawings, specifications, and other Contract Documents of the above project presently on file in the City Clerk, City of Tulsa Oklahoma:

CERTIFIES THAT he has inspected the site of the proposed work and has full knowledge of the extent and character of the work involved, construction difficulties that may be encountered, and materials necessary for construction, class and type of excavation, and all other factors affecting or which may be affected by the specified work; and

CERTIFIES THAT he has not entered into collusion with any other bidder or prospective bidder relative to the project and/or bid: and

HEREBY PROPOSES: to enter into a contract to provide all necessary labor, materials, equipment and tools to completely construct and finish all the work required by the Contract Documents hereto attached and other documents referred to therein: to complete said work within **546** calendar days after the work order is issued; and to accept in full payment therefore the amount set forth below for all work actually performed as computed by the Engineer as set forth in the Contract.

Basis of Award

IT SHOULD BE NOTED THAT THE LOWEST RESPONSIVE BID SHALL BE DETERMINED BY THE TOTAL BASE BID PLUS ADDITIVE ALTERNATES NO. 1. THE ITEMS IN ADDITIVE ALTERNATES 1 MAY OR MAY NOT BE INCLUDED IN THE CONTRACT AWARD AT THE SOLE DISCRETION OF TMUA. ANY PROPOSAL SUBMITTED WITH THE ADDITIVE ALTERNATE NO.1 INCOMPLETE SHALL BE CONSIDERED NON-RESPONSIVE.

Note: - Item numbers omitted are not a part of the Contract.

PROPOSAL
PROJECT NO. TMUA-W 24-03

BID ITEM	SPEC NO.	DESCRIPTION	UNIT	QTY	DATA INPUT UNIT PRICE	TOTAL EACH ITEM
BASE BID MOHAWK WTP CHEMICAL TANK REPLACEMENT						
1	SPECIAL	ALL WORK AS DEFINED IN THE CONTRACT DOCUMENTS, EXCEPT THOSE ITEMS LISTED SEPARATELY BELOW	EA	1		$ -
2	02 41 00	DEMOLITION	EA	1		$ -
3	43 41 45	18,900 GALLON 50% SODIUM HYDROXIDE FIBERGLASS REINFORCED PLASTIC TANKS	EA	3		$ -
4	43 41 45	18,900 GALLON 50% ALUMINUM CHLOROHYDRATE FIBERGLASS REINFORCED PLASTIC TANKS	EA	3		$ -
5	43 41 45	12,600 GALLON 25% HYDROFLUORSILICIC ACID FIBERGLASS REINFORCED PLASTIC TANKS	EA	1		$ -
6	43 41 45	12,600 GALLON CATIONIC POLYMER FIBERGLASS REINFORCED PLASTIC TANKS	EA	1		$ -
7	43 41 43	500 GALLON 50% SODIUM HYDROXIDE POLYETHYLENE UPRIGHT STORAGE TANK	EA	2		$ -
8	40 72 23	RADAR LEVEL METERS	EA	8		$ -
9	40 73 45	WEIGHT SCALE	EA	2		$ -
10	43 42 56	SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMPS	EA	3		$ -
11	SPECIAL	ELECTRICAL IMPROVEMENTS	EA	1		$ -
12	40 68 63	DCS AND OWS PROGRAMMING	EA	1		$ -
13	COT 303	MOBILIZATION/DEMOBILIZATION	EA	1		$ -
14	01 20 00	CHEMICAL ALLOWANCE	ALLOW	1	$245,000.00	$ 245,000.00
15	SPECIAL	OWNER ALLOWANCE	ALLOW	1	$125,000.00	$ 125,000.00
		BASE BID MOHAWK WTP CHEMICAL TANK REPLACEMENT SUBTOTAL				**$ 370,000.00**
ADDITIVE ALTERNATE NO. 1 MOHAWK WTP CHEMICAL TANK REPLACEMENT						
16	01 23 00	ADD ALTERNATE NO. 1 - SODIUM HYDROXIDE TRENCH CLEANING AND COATING	EA	1		$ -
		ADD ALTERNATIVE NO. 1 MOHAWK WTP CHEMICAL TANK REPLACEMENT SUBTOTAL				**$ -**
		TOTAL BASE BID + ADDITIVE ALTERNATE NO. 1				**$ 370,000.00**

TOTAL BASE BID	$370,000.00
ADD ALTERNATIVE NO. 1	$0.00
BASE BID PLUS ADDITIVE ALTERNATE	$370,000.00

Enclosed is a ( ) Bidder's Surety Bond, ( ) Certified Check, ( ) Cashier's Check for

_____ Dollars ($_____)
Figures

which the City of Tulsa may retain or recover as liquidated damages in the event that the undersigned fails to enter into contract for the work covered by this proposal., provided the Contract is awarded to the undersigned within thirty (30) days, or within ninety (90) days if Federal funds are utilized, from the date fixed for opening of bids and the undersigned fails to execute said Contract and furnish the required bonds and other requirements as called for in these Contract Documents within thirty (30) days after award of Contract.

Dated at Tulsa, Oklahoma, this _____ day of _____, 20__.

Respectfully submitted,

_____
(Complete legal name of company)

_____
(State of Organization)

By: _____
Title:
Printed Name:

ATTEST: _____
Title: Corporate Secretary
Printed Name:

(SEAL)

Address: _____
_____
_____
_____
_____

Telephone Number: _____ Fax Number: _____

By signing above the bidder acknowledges receipt of the following Addenda (give number and date of each):

_____
_____
_____
_____

WORSECTION 01 14 00 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Work restrictions.
   2. Work sequencing.

B. Related Section:
   1. Section 01 20 00 – Price and Payment Procedures.
   2. Section 01 32 16 – Construction Progress Schedule.
   3. Section 01 50 00 – Temporary Facilities and Controls
   4. Section 01 70 00 – Execution Requirements
   5. Section 01 77 00 – Closeout Procedures

1.2 GENERAL WORK RESTRICTIONS

A. Water Treatment Facilities:
   1. The existing Mohawk Water Treatment Plant is one of two of the City of Tulsa's means of treating and distributing potable water to the City's potable water customers. Impairing the operational capabilities of this facility will result in serious financial damage to the City and result in water usage restrictions for the City's potable water customers.
   2. Contractor shall bear the cost of penalties imposed on the Owner for potable water quality or other violations caused by actions of the Contractor.
   3. Conduct work in a manner that WILL NOT impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant as mandated by the Oklahoma Department of Environmental Quality to treat the quality of potable water to applicable water quality regulations.
   4. The status of the treatment plant shall be defined as "operational" when it is capable of treating the rated capacity of 100 mgd of potable water production as set forth by the State regulations.

B. Construction Scheduling Requirements
   1. Demolition and construction of all equipment shall commence no earlier than November 1, 2026 and must reach substantial completion by April 30, 2028.
   2. Chemical tanks construction can only occur between the calendar months of November 1, 2027 and April 30, 2028
   3. Dry polymer equipment demolition to start by November 15, 2026.
   4. Complete chemical storage tank and other long lead equipment item submittals by January 15, 2027.
   5. Order chemical storage tank and other long lead equipment items by February 15, 2027.

C. Time Restrictions for Performing Work:
   1. Regular operating hours as determined by the Owner.

D. Onsite Workday Restrictions:
   1. DO NOT perform Work on Site during Work blackout days specified by Owner.

E. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction (AHJ).

F. Provide safe, continuous access to process control equipment for plant operations personnel.

G. Noise, Vibration, Dust, and Odors:
   1. Coordinate with Owner operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy.
   2. Notify Engineer or Owner NOT less than two days in advance of proposed disruptive operations.
   3. Obtain Engineer's or Owner's written permission before proceeding with disruptive operations.

H. Smoking and Controlled Substance Restrictions:
   1. Use of tobacco products, alcoholic beverages, marijuana, and other controlled substances on Project Site, premises, or on Owner's property is NOT permitted.

I. Employee Identification:
   1. Provide identification tags for Contractor personnel working on Project Site. Require personnel to use identification tags at all times.

J. Employee Screening:
   1. Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project Site.
   2. Maintain list of approved screened personnel with Owner's representative.

1.3 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site:
   1. Contractor shall have limited use of Project Site for construction operations as specified in Drawings by the Contract limits and as specified in this Section.

B. Limits on Use of Site:
   1. Limit use of Project Site to Work in areas specified.
   2. DO NOT disturb portions of Project Site beyond areas in which the Work is specified.

C. Limits on Use of Site:
   1. Limit use of Site and premises to allow:
      a. Owner occupancy.
      b. Work by Owner.
      c. Work by Others.
      d. Use by the public where required.
   2. Driveways, Walkways, and Entrances:
      a. Keep driveways, parking areas, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. DO NOT use these areas for parking or for storage of materials.
      b. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on Site.

D. Construction Operations:
   1. Limited to areas specified in Drawings.
   2. Noisy and Disruptive Operations (such as Use of Jack Hammers and Other Noisy Equipment):
      a. NOT allowed in close proximity to existing building during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.

E. Sound Level Restrictions:

1. Sound pressure level measured at boundary of Site SHALL NOT exceed levels required by local ordinances or codes, and at NO time shall exceed 80 dBA

1.4 FACILITY OPERATIONS

A. Existing Utility Interruptions:
   1. DO NOT interrupt utilities serving facilities occupied by Owner or others unless permitted under the conditions, and only after arranging for temporary utility services as specified:
      a. Notify Engineer and Owner NOT less than seven days in advance of proposed utility interruptions.
      b. Submit outage request plan to Engineer and Owner itemizing dates, times, and duration of each requested outage.
      c. Obtain Owner's written permission before proceeding with utility interruptions.

B. Existing Operations Interruptions:
   1. DO NOT shutdown, interrupt, or otherwise impair the operational capability of treatment facilities or processes unless permitted under the following conditions. A facility or process shall be considered operational when it can achieve its defined treatment or process objective as defined by the Owner or Engineer.
   2. Specify required shutdowns of existing facilities or interruptions of existing operations on Construction Progress Schedule.
   3. Where required to minimize interruptions or impairments to systems operations while complying with specified work constraints, provide temporary treatment equipment, pumping, bypass systems, connections, power, lighting, controls, instrumentation, and safety devices.
   4. DO NOT remove or demolish systems required to keep the existing facilities operational at the capacities specified until the existing systems are replaced by temporary or new systems.

C. Shutdown Constraints:
   1. Perform work within critical operational constraints:
      a. Temporary chemical feed systems
      b. Sodium Hydroxide metering pumps to remain in service the entire length of the project.

D. Shutdown Definitions:
   1. Minor Shutdown:
      a. Any shutdown requiring less than 4 hrs.
   2. Major Shutdown:
      a. Any shutdown other than a minor shutdown.

E. Shutdown Procedures:
   1. Notify Engineer and Owner NOT less than 14 days in advance of proposed minor shutdowns.
   2. Notify Engineer and Owner NOT less than 30 days in advance of proposed major shutdowns.
   3. Contractor shall schedule a shutdown coordination meeting with Owner and Engineer one week prior to each shutdown.
   4. Any and all plant shutdowns shall require a shutdown plan, including detailed schedule, backup tools and equipment, personnel involved, contingency plan, and any procedures involved in restarting the process or facility.
   5. Obtain Engineer's or Owner's written permission before proceeding with proposed shutdowns.

1.5 WORK SEQUENCE

A. Use identified work sequences in this section as a GUIDELINE for scheduling and performing work. Perform work in a manner that WILL NOT prevent the facility from achieving the final treated water quality requirements established by regulation. It is ultimately the responsibility of the Contractor to execute the work in a sequence that meets all requirements of the contract documents.

B. Work sequence and constraints presented DO NOT include all items affecting completion of the Work. They are intended to describe critical events necessary to minimize disruption to existing operations and to ensure compliance with treatment regulations and permit requirements.

C. Construct Work in stages during construction period. Coordinate construction schedule and operations with the Owner:
   1. Stage 1: Demolish existing dry polymer equipment and removal of pilot filtration equipment. Coordinate with owner on storage pilot filtration equipment and associated platforms.
   2. Stage 2: Construct temporary hydrofluorosilicic acid (HFS) and cationic polymer (CPO) storage and chemical transfer lines where pilot equipment was located.
      a. Sequence 1: Connect CPO totes to existing CPO transfer pump that supplies existing day tanks.
      b. Sequence 2: Install a new HFS transfer pump and connect to HFS totes and existing HFS day tank.
      c. Sequence 3: Test temporary chemical bulk storage and transfer pump.
   3. Stage 3: Demolish existing aluminum chlorohydrate (ACH) Tank 7-T-3, HFS and CPO bulk storage tanks and associated tank piping. Protect valves as they will be reused.
   4. Stage 4: Demolish exiting ACH tank 7-T-1 and associate piping, valves to be protected and reused. ACH tank 7-T-2 to remain in service.
   5. Stage 5: Install the new ACH tank 7-T-1 and connect to the existing chemical system. Verify tank is feeding existing chemical feed system.
   6. Stage: Demolish existing ACH tank 7-T-2 and piping and install the new tank 7-T-2. Valves to be protected and reused.
   7. Stage 6: Install the new HFS tank 7-T-8 and connect to the existing chemical feed system.
   8. Stage 7: Install the new CPO tank 7-T-6 and connect to the existing chemical feed system.
   9. Stage 8: Install new ACH tank 7-T-3.
   10. Stage 9: Remove temporary HFS and CPO chemical storage and transfer system.
   11. Stage 10: Demolish Sodium Hydroxide (NaOH) tanks 7-T-11 and 7-T-12 and associate pipe. Tank 7-T-10 and NaOH feed system to remain in service. Protect valves as they are to be reused. Containment curbing can be removed to expedite removal and installation of tanks. Temporary containment curbing must be in place during demolition and construction. Transition to 25% Sodium Hydroxide (SHX) during demolition and construction of NaOH storage tanks.
   12. Stage 11: Install new NaOH tanks 7-T-12 and temporarily connect to existing NaOH feed system progressive cavity pumps.
   13. Stage 12: Demolish existing NaOH tank 7-T-10.
   14. Stage 13: Install new NaOH tanks 7-T-11 and 7-T-10. Temporarily connect back to the existing chemical feed system progressive cavity pumps.
   15. Stage 14: Install NaOH day tanks and transfer pumps. Connect tanks 7-T-10 and 7-T-11 to new transfer pumps while leaving 7-T-12 connected to existing chemical feed progressive cavity pumps.
   16. Stage 15: Disconnect 7-T-12 from existing chemical feed and connect new NaOH day tanks to existing chemical feed pumps. Connect new tank 7-T-12 to day tanks. Replace any containment curbing demolished during NaOH equipment installation with new concrete containment curbing.

17. Reinstall pilot filter equipment.

1.6 SEQUENCING OF CONSTRUCTION PLAN

A. Before start of construction, post electronic file to Project website of construction plan regarding phasing of project and new Work for acceptance by Owner.

B. After acceptance of plan, comply with accepted plan when coordinating construction sequencing unless deviations are accepted by Owner in writing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

SECTION 01 20 00 – PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Chemical allowance
   2. Defect assessment

1.2 CHEMICAL ALLOWANCE

A. Refer to the Bid Form for Chemical Allowance schedule.

B. The allowance shall be used for the cost of materials, labor, installation, and overhead and profit, in accordance with GC-26, for supplying temporary chemicals and maintaining the temporary chemical storage system, as described in specification 01 50 00 Temporary Facilities, during the rehabilitation construction of the chemical building.

C. The allowance shall be used only at the discretion of the City. Any allowance balance remaining at the completion of the Project will be retained by the City of Tulsa.

D. The Contractor shall provide, to the City, a written request for the use of the allowance, with a schedule of values, and associated backup information, including supporting documentation for labor, equipment, materials, overhead and profit, and any time extensions required to perform the work. This is required with each billing cycle.

E. The Contractor shall proceed with the work included in the allowance only after receiving a written order, from the Engineer and City, authorizing such work. Proceeding with work in the allowance without written order from the City will be at the Contractor's cost.

1.3 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Engineer or Owner, it is not practical to remove and replace the Work, Engineer or Owner will direct appropriate remedy or adjust payment. Potential remedies may include:
   1. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Engineer or Owner.
   2. Defective Work will be partially repaired according to instructions of Engineer or Owner, and unit sum/price will be adjusted to new sum/price at discretion of Engineer or Owner.

C. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.

D. Authority of Engineer or Owner to assess defects and identify payment adjustments is final.

E. Nonpayment for Rejected Products:
   1. Payment will not be made for rejected products for any of the reasons below:
      a. Products wasted or disposed of in a manner that is not acceptable.
      b. Products determined as unacceptable before or after placement.
      c. Products not completely unloaded from transporting vehicle.
      d. Products placed beyond lines and levels of the required Work.
      e. Products remaining on hand after completion of the Work.

f. Loading, hauling, and disposing of rejected products.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02 41 00 – DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Portions of buildings and other areas, equipment and materials selective demolition, and partial demolition work are as specified in Drawings.
   2. Equipment and materials to be removed for construction and reinstalled for reuse or continued operation are as specified in Drawings.
   3. Handling and disposal of chemicals in storage tanks.

B. Related Sections:
   1. None

1.2 SUBMITTALS

A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop Drawings:
   1. Plans specifying all equipment and materials to be removed and reinstalled for reuse on continued operation including interim storage plans for each item.

C. Quality requirements Submittals:
   1. Schedule of demolition, as part of and consistent with the progress schedule specified in Section 01 32 16 – Construction Progress Schedule.
   2. Methods of demolition and equipment proposed to demolish each structure.
   3. Copies of any authorizations and permits required to perform Work.

D. Tank Pad Inspection Requests for Information:
   1. Upon removal of tanks, inspect tank pads for cracking or spalling of concrete. Submit an RFI, with photographs and measurements of the cracks and spalling to allow Owner and Engineer to determine if the pad will be repaired or replaced.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Utilities:
   1. Notify Owner and appropriate utilities 72 hrs. prior to turning off affected services before starting demolition or alterations.
   2. Remove utility lines exposed by demolition excavation.
   3. Remove electric, sanitary, and storm drainage adjacent to buildings to be demolished.
   4. Excavate utility lines serving buildings to be demolished and provide a permanent leak-proof closure for water and gas lines.
   5. Plug sewer lines at locations shown or at limits of excavation if NOT shown with min. 2,000 psi compressive strength concrete plug to prevent groundwater infiltrating sewer systems. Length of plug shall be 5 ft minimum.

B. Removal and Storage of Equipment for Reuse:
   1. DO NOT remove equipment and materials without approval of Engineer.

2. Properly store and maintain equipment and materials in same condition as when removed.
3. Engineer shall determine condition of equipment and materials prior to removal.

3.2 CHEMICAL TANK DRAINING AND DECOMMISIONING

A. General Contractor Responsibility: Prior to the removal, cutting, or structural disturbance of any existing chemical storage tank scheduled for demolition, the Contractor shall safely remove all chemical contents. The Contractor shall execute one of the three following methods for volume management, assuming all associated coordination, equipment, and regulatory liabilities

1. Option 1 - On-Site Chemical Transfer (Preferred Method)

a. Transfer active chemical volumes from the tank(s) slated for demolition into the remaining active tank(s).

b. Provide all necessary temporary chemical-resistant pumps, reinforced hoses, manifolds, and secondary containment structures to prevent spills during transfer.

c. Contractor shall coordinate with the Owner to ensure the receiving tank does not exceed its maximum safe operating fill capacity prior to initiating transfer operations

2. Option 2- Chemical Neutralization and Legal Disposal

a. If on-site transfer is not executed, the Contractor shall neutralize all residual chemical volumes in-situ or in an approved temporary processing vessel on-site based on directions provided by chemical manufacturer.

b. The Contractor shall submit a neutralization and discharge plan detailing how the chemical is to be neutralized and any flushing methods required.

c. The Contractor shall treat and neutralize chemical contents to achieve a stabilized, non-hazardous state meeting all local municipal wastewater discharge limits. The effluent must be verified to have a pH between 7.0 and 8.5, and conform to all local temperature, heavy metal, and chemical oxygen demand thresholds prior to release.

d. Upon written verification of compliant test results, the Contractor may legally discharge the neutralized fluid into the facility's designated sanitary sewer system at a controlled flow rate approved by the Owner.

e. The Contractor is solely responsible for securing all necessary temporary discharge permits from the local utility provider, paying any associated disposal fees, and maintaining a continuous log of discharge volumes, times, and corresponding pH testing data. Do not discharge unverified or untreated chemical effluent into the storm sewer or directly onto the ground.

or

3. Option 3

a. Legally transport and dispose of all non-neutralized or neutralized hazardous waste off-site using a licensed hazardous waste hauler in strict accordance with EPA and DOT regulations.

B. Purging and Flushing: Following the evacuation or transfer of bulk chemicals, the Contractor shall thoroughly flush and purge the interior of the tanks, connected pumps, and adjacent piping with an appropriate neutralizing agent or solvent.

1. Flush the system until rinsing agents return a neutral baseline, indicating the removal of all corrosive or toxic residues.

2. Capture, test, and legally dispose of all flushing and rinsing fluids; do not discharge unverified effluent into the building or municipal sewer systems.

C. Verification and Certification: No tank demolition, cutting, or physical removal from the structural pad shall occur until the Contractor's safety officer tests the tank interior

atmosphere and surface residues, certifies the vessel is clean and safe for demolition, and provides written verification to the Owner's or Owner's Representative.

3.3 DEMOLITION

A. Drawings define minimum portion of equipment to be removed and structures to be modified. Unless otherwise specified, rough cuts or breaks may be made exceeding limits of demolition shown.

B. Provide all demolition, removal, temporary storage, and reinstallation of existing equipment as required for implementation of the work.

C. Core drill floor slabs, catch basins, and other concrete improvements to remain in place below ground, or break holes at structure's lowest point to allow water to freely migrate through.

D. Remove piping from areas to be backfilled. Pipe, valves, and fittings adjacent to those to be removed may also be removed as salvage.

E. Remove all materials associated with existing equipment that is to be removed or relocated.

F. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 in. below final finished surface.

G. Cut off drilled piers a minimum of 6 in. below bottom of new foundations.

H. Demolish existing concrete structure to 18 in. below grade.

3.4 DISPOSAL

A. Dispose of debris and other non-salvaged materials offsite in licensed landfills.

3.5 BACKFILLING

A. Demolished Areas:
   1. Backfill to existing ground level, elevations shown, or foundation level of new construction.

B. Backfill Material and Compaction:
   1. DO NOT use demolition debris as backfill material.

3.6 SALVAGE

A. Equipment and materials NOT reused or reinstalled, including all metals and piping within the limits of demolition, unless otherwise specified, shall be removed by the Contractor.

END OF SECTION

SECTION 40 61 13 – PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. The Work to furnish all materials, labor, equipment, tools, supplies, and incidentals necessary for the installation and testing of all process control systems.

B. Related Sections:
   1. Section 40 67 23 – Control Panels
   2. Section 40 68 63 – DCS and OWS Programming
   3. Section 40 70 00 – Instrumentation for Process Systems

1.2 DEFINITIONS:

A. OWS:
   1. Operator Workstation (Operator Monitor and Control Process through Graphical Displays)

B. OIT:
   1. Operator Interface Terminal

C. DCS:
   1. Distributed Control System

D. I/O:
   1. Input/Output

E. INFI-NET (Plant Loop):
   1. Bailey/Harmony redundant token-passing control network interconnecting controllers, I/O, and gateways.

F. VFD:
   1. Variable Frequency Drive

G. SSRVS:
   1. Solid State Reduced Voltage Starter (“Soft Starter”)

H. RTU:
   1. Remote Telemetry Unit

I. MTU:
   1. Master Telemetry Unit

J. MCC:
   1. Motor Control Center

K. Operating Program:
   1. Operating system, Operator Workstation, or other core software.

L. Integrated Operating Platform:
   1. System of installed, connected, and configured hardware, operating programs, and networking equipment.

M. DCS and OWS Programming:
   1. Software configuration of operating programs to implement process control strategies.

N. Control System Specialist:
   1. A company specializing in process control hardware and software, including instrumentation, DCS, networking, installation, and configuration.

O. Controlway:
   1. Backplane bus within Harmony/INFI 90 I/O racks

P. Composer for Harmony (Programming Tool):
   1. ABB engineering/configuration environment for Harmony/INFI 90.

Q. OPC Gateway:
   1. ABB Harmony/INFI 90 OPC (DA/UA) server or S+ Operations interface for HMI/SCADA connectivity.

R. Harmony Controller:
   1. Primary controller class used in INFI 90 systems.

1.3 SUBMITTALS

A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data:
   1. Instrument Installation Details.
   2. Certified Calibration Sheets.
   3. Complete and detailed instruction manuals on each item furnished including but not limited to all devices and instruments. Information to be contained in the instruction manuals shall include but not be limited to drawings, dimensions, manufacturer's recommendations, ratings, performance charts, power requirements, schematics, maintenance requirements and procedures, calibration recommendations and procedures, repair instructions, complete and recommended spare parts lists and related information.
   4. Proposed tagging and attachment materials and methods.
   5. INFI-NET topology (redundancy, drops, media, and node addresses).
   6. Rack and module BOMs
   7. OPC/OWS interface details

C. Shop Drawings:
   1. Shall be submitted for approval by the Engineer.
   2. The Contractor shall submit to the Engineer, for approval, Shop Drawings of the equipment to be installed to meet the sections. The Drawings shall be supported by notes or written directions as required to fully define the installation. The submission shall be made as soon as feasible after award of the Contract and, in any event, shall be submitted and approval obtained before installation of the equipment.
   3. The information required on the Shop Drawings shall include, but is not necessarily limited to:
      a. Full and complete specifications covering the equipment proposed to be furnished.
      b. Detail Drawings showing plan, network connections and elevation dimensions of the equipment proposed to be furnished.
      c. Guarantees of performance of the equipment proposed to be furnished.
      d. Nearest location of factory maintenance and service facilities that will be available to service the equipment offered.

e. To scale plans, sections and elevations detailing entire installation. Include mounting hardware, brackets, assemblies, and other devices as required for a complete installation.
f. INFI-NET network drawings
g. Harmony rack elevations
h. Marshalling details

4. Control panels:
a. Panel and subpanel layout
b. Point-to-Point Wiring and Interconnection Diagrams
c. System hardware

D. Contract Closeout Submittals:
1. Project Record Documents
2. Operating and Maintenance Data
3. Warranty
a. See Section 01 78 36 – Warranties and Bonds for additional requirements.
4. Final as-built copies of documented DCS and OWS programs for vendor supplied equipment packages, on electronic media, suitable for future troubleshooting or modifications by others.
5. Deliver composer project, exported tag list, OPC address map, and controller images/backups.
6. OWS handoff, if OWS is 800xA or a 3rd-party OWS, include connection guide and tested node list.
7. Firmware/versions matrix for all new equipment including but not limited to:
a. Controllers
b. I/O modules
c. Gateways
d. OPC server

E. Instrumentation and control testing documents shall be submitted for approval by the Engineer:
1. Credentials of technicians doing the inspection and testing.
2. Written certification as detailed under testing requirements in this section.

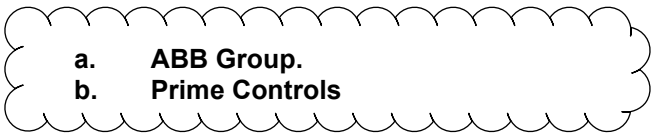
1.4 QUALITY ASSURANCE

A. The Contractor shall designate in writing the qualified Control System Specialist, including a detailed listing of the firm, resumes and work history of each person working on the project, and project specific references. The qualifications of the Control System Specialist shall be subject to approval of the Owner and the Engineer.

B. The minimum qualifications for the Control System Specialist shall include:
1. An established firm in operation as a control and automation company for a minimum of 5 years, with demonstrated water and wastewater industry experience.
2. Staffed with experienced personnel capable of executing the required aspects of the project.
3. Documented ABB Harmony/INFI-90 commissioning experience in water/wastewater industry and Composer proficiency.
4. ABB-approved/authorized integrator for Harmony work.

1.5 SCOPE OF WORK

A. The Contractor shall engage the services of a Control System Specialist, who shall furnish all materials, equipment, labor, and services to achieve a fully functional process control system for this project, except for those services specifically excluded herein to be provided by an Application Engineer.
1. The Control System Specialist shall be:



B. The Control System Specialist shall be responsible for providing and installing all instrumentation, DCS controllers, computer equipment, networking equipment, and other control system hardware as specified for a complete process control system installation.

C. In general, the Control System Specialist shall:
   1. Provide Composer Harmony configuration, function-code logic, controller loading, OPC/S+ interface, and OWS screen development to implement process control of equipment described within Section 40 61 96 - Process Control Descriptions.
   2. Furnish, install, configure, and calibrate instrumentation as detailed on the drawings and in the sections.
   3. Fabricate and install all control panels as specified in Drawings, except for those provided as part of a vendor supplied equipment package. Terminate all field control wiring inside control panels.
      a. Where existing control panels are being replaced with new, field investigate and develop as-builts of the existing instrumentation and control installation to identify and label all I/O and communication wiring entering the existing panels. The contractor shall be responsible for properly identifying and labelling all existing wiring and reconnecting to the new control panel. Perform point-to-point wiring checks and startup testing for reconnected existing components and wiring following the same requirements as new equipment.
   4. Provide all hardware required to properly communicate between all control panels and remote sites, whether or not explicitly identified in the drawings or sections.
   5. Install networking equipment and communication cables between control devices as specified in Drawings and sections. Provide configuration of equipment, including network switches and firewalls, to ensure proper communication between all devices associated with the integrated operating platform.
   6. Provide all instrumentation and control device relocation work associated with the relocation of equipment, including disconnecting all existing wiring and conduit and terminating, calibrating, and replacing service to relocated equipment.
   7. Modification to existing instrumentation and control systems as required to new and existing equipment to maintain process operations.
   8. Provide overall coordination, installation, supervision, and installation of control panels, instrumentation, computer hardware, networking systems, and other miscellaneous control system components as specified.
   9. Provide coordination with the Contractor and participate in all meetings as directed by the sections or Contractor.
   10. Execute the testing procedures outlined in this document.

D. Vendor system packages may be provided under other sections of this contract that may interface with the process control system via communications protocol and/or hardwired I/O. Refer to the associated sections and the contract drawings for additional details. The Control System Specialist shall be responsible for coordination, furnishing, installing, and configuring any communication devices or drivers necessary to ensure proper communication with each of the vendor-furnished systems.

E. Vendor system packages may include instrumentation or control panels that shall be installed and configured by the Control System Specialist as specified in vendor instructions. Upon satisfactory installation, configuration, and calibration, the Control System Specialist shall coordinate with each vendor to inspect finished work. The Control System Specialist shall submit documentation indicating that the vendor has inspected and approved the installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:
   1. Delivery, storage, and handling shall be as specified in Manufacturer's recommendation and the requirements of other sections herein.

1.7 PROJECT AND SITE CONDITIONS

A. Environmental Requirements:
   1. Instrumentation and control elements may be installed outdoors exposed to sun, rain and excessive humidity and shall be capable of continuous operation without significant reduction of their operating life under the ambient conditions below:
      a. Temperature:
         1) (-25)°C – 80°C
      b. Pressure:
         1) 650 mm Hg – 800 mm Hg
      c. Relative Humidity:
         1) 20% – 100% condensing
      d. Vibration Frequency:
         1) 10 Hz – 2000 Hz
      e. Vibration Position:
         1) 1.5 mm peak-to-peak
      f. Vibration Acceleration:
         1) 10 G.

B. Where the ratings of individual components cannot meet the requirements, provide suitable means of physical protection. Suitable physical protection shall consist of an assembly which meets the requirements listed, while limiting the ambient conditions at the non–conforming component to 90% of the component's rating (Example: A component rated for vibration at only 5 G. acceleration would be required to be combined with vibration isolation to limit the acceleration of the component to 4.5 G. when subjected to ambient acceleration of 10 G. from 10 Hz – 2000 Hz.).

C. Operating Environmental Conditions:
   1. All instruments and control devices provided shall be rated for continuous operation in their installed operating environment and shall be capable of continuous operation at the operating conditions without significant reduction of their operating life.

D. All controlling devices shall be NEMA or IEC rated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. All meters, instruments, control units, and other components shall be the most recent field proven models marketed by their respective manufacturers at the time of the submittal of the shop drawings unless otherwise specified to match existing equipment.

B. Analog measurements and control signals shall be electrical and shall vary in direct linear proportion to the variable being measured. All analog signals whether inputs or outputs shall be 4 mA – 20 mA DC unless otherwise noted. The analog input signals shall maintain loop integrity with the installation of properly sized resistors across the input terminals. Provide surge protection for all analog signal terminations.

C. All of the elements, instruments, accessories, and assemblies shall be installed as specified in the manufacturer's installation instructions, and as detailed on the Drawings. Shielded instrumentation cables shall be used for all analog signals from the instruments to the DCS panels. Separate conduits shall be used for instrument power, instrument signals, and fiber optic cables.

D. All instruments installed outdoors subject to direct sunlight shall include a stainless-steel sunshade.

E. All digital outputs shall be isolated from the field equipment through an interposing relay. The relays shall be mounted inside the DCS cabinets.

F. The Contractor shall make the necessary power connections and signal connections from the field devices (i.e., instruments, control valves, etc.) to the DCS cabinet.

G. The Contractor shall configure and verify proper operation of the Integrated Operating Platform, included but not limited to:
   1. The computers, OITs, networking hardware, surge protection devices, uninterruptible power supplies, and other incidental equipment shall be configured and installed as shown on the Drawings and as specified herein.
   2. All networked devices shall be configured for proper communication via the topology and protocol shown on the Drawings or specified herein.
   3. Verify that all system devices power up, function, and properly communicate prior to commencing any startup or testing procedures as described herein.

3.2 SYSTEM WIRING COORDINATION

A. The Control System Specialist shall develop complete point-to-point interconnection wiring termination sheets for all control connections to be provided for the project. The sheets shall identify all external interconnecting wiring associated with all new control panels or existing control panels.
   1. Develop point-to-point interconnection wiring termination sheets for performance of the Work and to document terminations.
   2. Use information from shop drawings, record drawings, plan drawings, and field inspections to develop sheets. Contractor shall field investigate the existing installation to determine the connections for equipment that is to remain and reconnected.
   3. The interconnection wiring termination sheets shall include:
      a. External wiring for each piece of equipment, panel, instrument, local control stations, and other field devices with an electrical connection.
      b. Numbered terminal block identification for each wire termination.
      c. Identification of the assigned wire numbers for all interconnections.
      d. Conduit tags, terminal numbers, and pull box identifications through which wiring is routed between end points.
      e. Identification equipment documents from which the wire numbering and termination information was obtained.
   4. Conduct point-to-point wiring checks to determine that wiring and terminations are installed in compliance with the point-to-point interconnection diagrams. The Control System Specialist shall document all wiring checks and signoff on completed wiring termination sheets. Submit signed documentation to Owner and Engineer.

3.3 TESTING AND INSTALLATION REQUIREMENTS

A. Testing and Installation Requirements:
   1. The Contractor shall be required to coordinate the following services during construction related to the testing and installation of the process control system. The complete system testing shall include all DCS panels, computer systems, network devices, interconnecting

cables, and other peripheral devices required for a complete and functional system. The testing of the system shall occur in stages as defined below. The Contractor shall develop and submit proposed testing procedures and documentation for each test. Testing documentation shall include signature lines for representatives of the Control Systems Specialist, Engineer, and Owner. Signatures shall be provided for each portion of the test, including a final signoff indicating satisfactory completion of the entire test. Any deviations from the test procedure or corrections made during test must be recorded on the documentation and initialed by individual making the record. Testing documentation submittals must be approved by the Engineer prior to the scheduling of any actual tests.

B. Factory Readiness Test:

1. A Factory Readiness Test shall be performed for each control panel fabricated and provided by the Control System Specialist. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. The Control System Specialist shall provide notice to the Engineer a minimum of thirty (30) days in advance of the test.
2. The purpose of the Factory Readiness Test is to verify that all hardware and wiring within the control panel has been properly constructed and ready for shipment to the project site, and to test the automatic and manual process control strategies through DCS and OWS programming. This control strategy portion of the testing will be primarily performed by the Application Engineer, with support from the Control System Specialist as needed.
3. The Control System Specialist shall assemble all hardware components within the specified enclosure, including the instruments, controllers, network components and other required items. This assembly shall be complete and considered suitable for field installation.
4. For the Factory Readiness Test, the Control System Specialist shall demonstrate that the control panel is suitable for field installation by powering up each item and testing for proper network connections. In addition, the Control System Specialist shall test each input and output for proper operation from each field connection point within the control panel. The Control System Specialist shall be responsible for all measurement and testing components required to complete the Factory Readiness Test.
5. The Control System Specialist shall be responsible for connecting test instruments to the DCS and verifying proper operation of each input and output. All wire and terminal numbers shall be checked for conformance with the submittal drawings during this Readiness Test.
6. Each analog I/O point shall be checked for proper operation from each field connection point in the control enclosure. The Control System Specialist shall simulate inputs and outputs in order to fully confirm the proper operation of each analog I/O. The loop tuning shall be performed on the controller using Composer, all final P/I/D values and anti-reset windup and bumpless transfer behavior shall be documented.
7. The Control System Specialist may load a test program in the DCS in order to facilitate the Factory Readiness Test.
8. Upon satisfactory completion of the control panel hardware and wiring portion of the test, the Application Engineer will load the DCS and OWS programming to begin functional testing of control strategies.
9. Each analog and discrete I/O signal will be checked through the DCS to the OWS screens to verify proper mapping of tags.
10. Functionality of the system will be checked to ensure conformance with process control strategies.
11. Process conditions and field equipment feedback will be simulated or forced in order to prove proper DCS response and logic functionality.
12. If during the Factory Readiness Test the Application Engineer, Engineer, or Owner finds that process control is not achievable due to errors in the control panel wiring or construction, the functional testing shall stop, and the Control System Specialist shall

correct the work and repeat the Factory Readiness Test at no additional cost to the Owner.

13. The Control System Specialist shall submit completed testing documentation as record to the Engineer upon satisfactory completion of the Factory Readiness Test prior to shipment of the control panels to the project site.

C. Site Readiness Test:

1. A Site Readiness Test shall be performed after the installation of all control system components including DCS control panels, communications, control wiring, device configurations, instrument calibrations, motor controllers, and variable frequency controllers as specified in the Contract Documents. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. The Control System Specialist shall provide notice to the Engineer a minimum of thirty (30) days in advance of the test.
2. The purpose of this test is for the Control System Specialist to verify:
    a. All instruments have been properly configured and calibrated.
    b. All field control wiring has been properly installed and terminated.
    c. All DCS control panel hardware is operating and communicating properly.
    d. The installation is ready for the Application Engineer to load DCS and OWS programming and begin functional process control testing.
3. Site Readiness Test shall include energization and testing for correct hardware integration of all system components, including DCS remote I/O assemblies, and reliable communications between components with correct protocols.
4. Provide point-to-point wiring checks for continuity between field devices to final DCS I/O terminations.
5. To the greatest extent possible, the Control System Specialist shall check I/O under process conditions to the end elements. For example, I/O for valve limit switches shall be checked by operating the valve to fully open and closed positions, rather than using jumpers or other means to simulate valve operation. Any testing performed that could upset or affect any live process shall be coordinated with the Owner.
6. Provide verification and documentation of normally closed or normally open contacts for discrete I/O signals.
7. Discrete inputs shall be tested by operating the end device to force a signal change. Observe results on all indicators such as DCS register, panel light, etc.
8. Discrete output signals shall be tested by forcing a value in the DCS register. Observe that the connected equipment properly responds.
9. Analog inputs shall be verified at 0%, 25%, 50%, 75%, and 100% of span. Observe results on all indicators such as DCS register, digital panel meters, etc.
10. Analog outputs shall be tested by entering values in the DCS register to force the outputs at 0%, 25%, 50%, 75%, and 100% of span. Observe that the connected equipment properly responds.
11. Personnel performing the test shall have International Society of Automation (ISA) Certified Control Systems Technicians (CCST) or equivalent credentials as approved by the Engineer or Owner.
12. The Control System Specialist shall submit completed testing documentation as record to the Engineer upon satisfactory completion of the Site Readiness Test.

D. Functional System Test:

1. Upon the Engineer's approval of the Site Readiness Test, the Application Engineer will load the DCS and OWS programming to begin functional testing of control strategies.
2. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. Although the Control System Specialist must provide notice to the Engineer a minimum of thirty (30) days in advance of the test, the Functional System Test may be performed consecutively with the Site Readiness Test if approved by the Engineer and Owner ahead of time.

3. The purpose of the functional system testing is to implement and test the automatic and manual process control strategies through DCS and OWS programming. This testing will be primarily performed by the Control System Specialist.
4. For this test, all equipment shall be installed, calibrated, and functioning as required in the contract documents.
5. Each analog and discrete I/O signal will be checked through the DCS to the OWS screens to verify proper mapping of tags.
6. Functionality of the system will be checked to ensure conformance with process control strategies.
7. DCS control loops will be tuned to achieve stable process control.
8. If during the Functional System Test the Engineer, or Owner finds that process control is not achievable due to errors in the installation, the functional testing shall stop, and the Control System Specialist shall correct the installation and repeat the Site Readiness Test at no additional cost to the Owner.

E. Final Acceptance Test:
1. After the system has been started up and running in automatic control to the greatest extent possible as determined by the Engineer/Owner, the Control System Specialist shall conduct a Final Acceptance test of the completed installation. The test shall start after satisfactory completion of all previous tests, the Engineer has received marked record (as-built) drawings from the Contractor, and when directed by the Owner/Engineer.
2. During this test, the Owner and Engineer shall have full use of the system. The duration of the test shall be 30 days.
3. Control System Specialist personnel shall be readily available to address issues onsite during the acceptance test.
4. The system shall operate with 100% reliability during the test period. Failure shall be defined as the inability to control or indicate status of specified inputs or outputs or any specified function of the control systems as described herein caused by defective hardware or software furnished in this project. Failure of hardware or software shall require repair or remedy of the defect to the satisfaction of the Engineer/Owner within 2 days. If the problem cannot be repaired in this time, the test shall be aborted and restarted after the problem is corrected and when directed by the Owner/Engineer. Restarting and satisfactory completion of the test shall be conducted at no additional cost to the Owner.
5. Throughout the duration of the test, no modifications shall be made to the system without prior approval from the Engineer or Owner.

3.4 TRAINING, STARTUP ASSISTANCE, & WARRANTY

A. Training:
1. The Contractor shall provide training for the purpose of familiarizing Owner’s personnel with the process control system. All training shall be as scheduled by the Owner. The training shall be scheduled a minimum of thirty (30) days in advance of when it is to be given. Proposed training materials, including a detailed training agenda itemizing relative emphasis on various topics of each course, shall be submitted to the Owner and Engineer at least fourteen (14) days in advance of when the training is to begin. The course content shall include, but not be limited to, a description of system philosophy, all major hardware components utilized in the system and hardware maintenance practices.

B. Startup Assistance:
1. The Contractor shall be responsible for furnishing a qualified technical representative who shall supervise the installation of equipment and/or install equipment, and who shall test, adjust, field calibrate, and fully commission all flow metering equipment, instrumentation equipment, control equipment, and accessories specified herein and required as integral components of the complete systems. The commissioning will be

deemed to be complete only after all systems are found to be performing satisfactorily following the final balancing of plant operation. The guarantee period, during which all defective materials shall be replaced, and all faulty workmanship will be corrected at no cost to the Owner, shall begin with the date on which the commissioning is judged to be complete.

C. Service:
   1. Manufacturers shall provide as part of the equipment cost sufficient days of service by a factory-trained service engineer specifically trained on the type of equipment herein specified to assist the Contractor during installation and startup. The service time shall be sufficient to place the units in satisfactory service and instruct the Owner's personnel in proper operation and maintenance of the equipment.
   2. A minimum of three (3) days service Engineer time shall be provided.

D. Maintenance Instruction:
   1. Operating and maintenance instructions, along with a separate parts list, shall be furnished in three (3) copies to the Owner. Operating instructions shall also incorporate a functional description of the system, including the system schematics which reflect "as-built" modifications. Maintenance requirements particular to the system shall be clearly defined, along with calibration and test procedures.

E. Warranty:
   1. All equipment and workmanship furnished under this contract shall be guaranteed to be free of defects in materials and workmanship for a period of one (1) year from and after the date of final acceptance of the work by the Owner, and any such defects which appear within the stipulated guaranty period shall be repaired, replaced, or made good without charge. This guarantee shall include the capacity and integrated performance of the component's parts.

END OF SECTION

SECTION 43 42 56 – SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-metallic Sealless Magnetic Drive Centrifugal Pumps, drivers, and accessories.

B. Related Sections:
   1. Section 26 05 93 – Electric Motors.
   2. Section 40 05 51 – Common Requirements for Process Valves.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

B. ANSI International:
   1. ANSI B73.3M
   2. ANSI B16.5

C. ASTM International:
   1. A27 – Standard Specification for Steel Castings, Carbon, for General Application.
   2. A29 – Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
   3. A48 – Standard Specification for Gray Iron Castings.
   4. A276 – Standard Specification for Stainless Steel Bars and Shapes.
   5. A536 – Standard Specification for Ductile Iron Castings.
   6. B91 – Standard Specification for Magnesium-Alloy Forgings.
   7. B505 – Standard Specification for Copper Alloy Continuous Castings.

D. Hydraulic Institute Standards

E. NEC (National Electric Code)

1.3 DEFINITIONS

A. Nonmetallic magnetic drive pumps:
   1. Use an encapsulated inner rotating assembly including a set of inner magnets within a containment shell or rear casing. Inner magnets are magnetically coupled or driven by outer magnet ring or drive magnet coupled to a conventional drive motor. Liquid end is hermetically sealed by static O-ring(s) or gasket(s).

B. Close-coupled drivers:
   1. Conventional drivers mounted directly to the pumps frame. No base, coupling, or guards are required for this mounting style.

C. Non-contact bearing/magnet system:
   1. Oversized drive and driven magnet set positioned such that reverse axial thrusting is reduced during adverse operating conditions minimizing contact of reverse axial thrust collars. This prevents contact with parts that close off circulation of air or fluid between radial bearing and pump shaft. Radial bearing is also positioned forward to maximize exposure to fluid/air circulation reducing frictional heat generation.

1.4 SUBMITTALS

A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data:
   1. Submit manufacturer information, including installation instructions, accessories, performance curves with specified operating point plotted, capacities and pressure differentials, power, rpm, sound power levels for both inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

C. Shop Drawings:
   1. Furnish diagrams showing the complete layout of the system, including equipment, piping, valves, wiring and ladder diagrams, controls, and control sequences.
   2. Indicate size and configuration of assembly, mountings, weights, and accessory connections.
   3. Indicate manufacturer's specified displacement tolerances for vibration at operational speed as specified for pumps.

D. Manufacturer's Certificate:
   1. Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions:
   1. Submit detailed instructions on installation requirements, including storage and handling procedures, anchoring, and layout.

F. Source Quality-Control Submittals:
   1. Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals:
   1. Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports:
   1. Certify that equipment has been installed according to manufacturer instructions.

I. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.
   2. Submit manufacturer's approval of installer.

J. Closeout Submittals:
   1. Section 01 77 00 –Closeout Procedures for submittal requirements.
   2. Project Record Documents:
      a. Record actual locations and final orientation of pumps and appurtenances.

1.5 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer:
   1. Company specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection:
   1. Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing them in clean, dry locations remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.7 WARRANTY

A. Provide a warranty for a period of 12 months after the final acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.

B. See Section 01 78 36 – Warranties and Bonds for additional requirements.

PART 2 - PRODUCTS

2.1 NONMETALLIC MAGNET DRIVE PUMPS

A. Manufacturers:
   1. March Pumps
   2. Finish Thompson
   3. Iwaki

B. General Design:
   1. Pumps shall be a non-metallic magnetic drive type, closed impeller design, male NPT suction and discharge connections, and close-coupled design.
   2. Wetted materials shall be compatible with the fluid being pumped.
   3. Pumps shall be overhung design with close-coupled drivers.
   4. Pumps shall comply with applicable sections of Hydraulic Institute Standards unless otherwise noted.
   5. Pumps, drivers and accessories shall be suitable for continuous operation at the specified operating conditions, and at flows ranging from the specified minimum flow to end-of-curve conditions.
   6. Pump head-capacity curve characteristics shall rise continuously from rated capacity to specified minimum flow. Pump rated capacity shall not exceed capacity at the best efficiency point. Pump design and selection shall permit a 5% head increase at rated flow by installing a new impeller unless otherwise noted.
   7. Required Net Positive Suction Head (NPSHr) shall be based on water. Available NPSHa shall exceed required NPSHr by a minimum of two feet.
   8. Any electrical drives or accessories shall be suitable for the specified electrical area classification and the environment of the installation.
   9. The impeller assembly shall be able to be removed without disturbing the piping connections. The liquid end shall be able to be removed without removing the motor frame adapter from the motor. The liquid and drive ends shall be independently serviceable.
   10. Pump shall have extended run dry ability when equipped with a carbon bushing.

C. Pump Casing:
   1. Design:
      a. Design: Single Piece Injection Molded
      b. Material: Glass Fiber Reinforced Polypropylene
      c. Connections: Male NPT for both suction and discharge connections. Connections shall have options for adjustable ANSI Class 150, standard hole pattern flanges or unions.
      d. Casing and containment shell shall form volute for maximum hydraulic efficiency.
      e. Casing shall be designed for specified design pressures, temperatures and hydrostatic test pressures.

D. Impeller
   1. Closed type design, one-piece construction, material compatible with fluid being pumped.
   2. Material:
      a. Glass Fiber Reinforced Polypropylene
   3. Allow for individual replacement.
   4. Statically and dynamically balanced after assembly.

E. Pump Shaft
   1. Material: High Purity Alumina Ceramic
   2. The pump shaft shall be uniform in diameter and include anti-rotation/positioning flats for securing rear thrust collar in the containment shell as well as positioning shaft in the containment shell.
   3. The shaft shall be supported on both ends and replaceable.

F. Thrust/Liner Ring
   1. Alumina Ceramic

G. Impeller Thrust Ring:
   1. PTFE

H. Bearings:
   1. One-piece press fit bearing or shaft bushing. The outside diameter of the bearing or bushing shall have an anti-rotation shape.
   2. Carbon

I. Driven Magnet:
   1. Encapsulated with Glass Filled Reinforced Polypropylene.
   2. The bore of the inner magnet shall have an anti-rotation/positioning flat that corresponds to the shape of the press fit radial bearing or bushing.
   3. Ferrite, Neodymium, Iron Boron

J. Containment Shell:
   1. One-Piece Design
   2. Material:
      a. Glass Fiber Reinforced Polypropylene

K. Rear Thrust Ring:
   1. Material:
      a. CFRPPS
      b. SiC

L. Drive Magnet:
   1. Ferrite or Neodymium
   2. The drive or outer magnet shall be dynamically balanced and be capable of mounting directly to standard NEMA motors.

M. Frame:
1. The motor frame adapter shall allow for mounting of standard NEMA C-Faced motors. The Frame shall include a non-metallic, single piece, reinforced plastic design base and shall not use the motor for support.

N. Drivers
1. Each driver shall have a BHP output equal to our greater than the horsepower required to operate the pump at any point on the head capacity curve, while pumping liquid of the specified specific gravity and viscosity.
2. All magnetic drives shall have torque ratings greater than or equal to the maximum motor torque the driver is rated for.

O. Electrical Characteristics:
1. See Division 26 – Electrical
2. Voltage: 230/460 V, three-phase, 60 Hz.

P. Motors:
1. As specified in Section 26 05 93 – Electric Motors.

2.2 CONTROLS

A. Manually Controlled by a local ON/OFF Switch.

2.3 SOURCE QUALITY CONTROL

A. See Section 01 40 00 – Quality Requirements for testing, inspection, and analysis requirements.

B. Provide shop inspection and testing of the completed assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. According to manufacturer instructions.

B. Provide and connect piping, power and control conduit, and wiring to make the system operational and ready for startup.

3.2 FIELD QUALITY CONTROL

A. See Section 01 60 00 – Product Requirements for inspecting and testing requirements.

B. Inspection:
1. Make sure that pumps have been installed correctly and that there is no objectionable heat or vibration.
2. Check pump and motor alignment, proper motor rotation, and pump and drive units for proper lubrication.

C. Testing:
1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Architect/Engineer.
2. Verify pump performance by performing time-drawdown test or time-fill test.

D. Manufacturer Services:
1. Furnish services of authorized manufacturer's representative experienced in the installation of products furnished under this Section for not less than 2 days on Site for

installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

E. Equipment Acceptance:
   1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
   2. Make final adjustments to equipment under the direction of the manufacturer's representative.

F. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.3 ADJUSTING

A. See Section 01 70 00 – Execution Requirements for starting and adjusting requirements.

B. Check control functions and adjust as required.

3.4 DEMONSTRATION

A. See Section 01 70 00 – Execution Requirements for demonstration and training requirements.

B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

3.5 ATTACHMENTS

A. The attachment list below part of this section:
   1. 44 42 56.31.1 – DS – Chemical Transfer Pumps – Sodium Hydroxide
   2. 44 42 56.31.2 – DS – Chemical Transfer Pumps – Hydrofluorosilicic Acid

Section 44 42 56.31.1:
NON-METALLIC LINED SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMP(S)
SODIUM HYDROXIDE

PROJECT: TMUA Mohawk WTP Chemical Tank
OWNER: TMUA
EQUIPMENT NAME(S): Sodium Hydroxide Bulk Transfer Pump
EQUIPMENT TAG NUMBER(S): XPMP01, XPMP02
CONTROL PANEL(S): See Drawings
TOTAL PUMPS REQUIRED: 2 (One Duty + 1 Standby)

MANUFACTURERS	SUGGESTED MODEL
March Pumps	-- As Recommended by Manufacturer
Finish Thompson	-- DB-8P-E-3-M277
Iwaki	-- MX-400

SERVICE CONDITIONS

Liquid Pumped: Sodium Hydroxide (50% and 25%)
Specific Gravity at 60°F: 1.52
Min. NPSH available: 22 ft
Explosion Proof (Y/N) N

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Design: 25
Total Dynamic Head (ft) Design: 30
Max. Pumping Temperature 90 °F
Max pump speed at rated capacity 3500 rpm

EQUIPMENT DESCRIPTION

Casing Material: Glass Fiber Polypropylene
Impeller Type: Enclosed
Impeller Material: Glass Fiber Polypropylene
O-Ring: EPDM
Impeller Thrust Ring: PTFE

Suction Flange: 1.5 in.
Discharge Flange: 1.5 (1) in.
Impeller Size: 3 in.
Bushing: Carbon
Self-Priming ☐: Non-Self Priming ☒

MOTOR DATA

Type: Chem Duty
Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.
Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing marking.

Motor Horsepower: 1
Voltage: 230/460
Phase: 3
Frequency: 60 Hz
Synchronous Speed: 3450 rpm (maximum)
Service Factor: ☐ 1.0 ☒ 1.15

Mounting Type: ☒ Horizontal ☐ Vertical
Enclosure Type: TEFC
Material: Ductile Iron w/ ETFE lining
Load Class:
☐ Multispeed, Two speed: _____ rpm

☐ Variable Frequency Drive: See Division 26 – Electrical. Provide Inverter Duty Rated Motors.
Windings: ☐ One ☐ Two ☒ Thermal protection embedded in windings
Motor nameplate horsepower shall not be exceeded at any operational point.
Provide: ☐ Space Heater ☐ Oversize main terminal (conduit) box for motors
☐ Moisture detection switches

SPECIAL FEATURES/NOTES

See Division 26 and Division 40 for general instrumentation and control requirements.

Suggested models are for reference only. Other models meeting the design criteria will be considered.

Section 44 42 56.31.2:
NON-METALLIC LINED SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMP(S)
HYDROFLUOROSILICIC ACID

PROJECT: TMUA Mohawk WTP Chemical Tank
OWNER: TMUA
EQUIPMENT NAME(S): **Hydrofluorosilicic Acid Temporary Transfer Pump**
EQUIPMENT TAG NUMBER(S): **Temporary**
CONTROL PANEL(S): **Local Disconnect with ON/OFF Switch**
TOTAL PUMPS REQUIRED: **1**

MANUFACTURERS	SUGGESTED MODEL
March Pumps	As recommended by manufacturer
Finish Thompson	**DB8**
Iwaki	As recommended by manufacturer

SERVICE CONDITIONS

Liquid Pumped: **Hydrofluorosilicic Acid (25 %)**
Specific Gravity at 60°F: **1.17**
Min. NPSH available: 22 ft
Explosion Proof (Y/N) N

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Design: **30**
Total Dynamic Head (ft) Design: **20(approximate)**
Max. Pumping Temperature 90 °F
Max pump speed at rated capacity 3500 rpm

EQUIPMENT DESCRIPTION

Casing Material: **Glass Fiber Polypropylene**
Impeller Type: **Enclosed**
Impeller Material: **Glass Fiber Polypropylene**
O-Ring: **EPDM**
Impeller Thrust Ring: **PTFE**
Suction Flange: **1.5 in.**
Discharge Flange: **1.5 (1) in.**
Impeller Size: **3 in.**
Bushing: **Carbon**
Self-Priming ☐: Non-Self Priming ☒

MOTOR DATA

Type: Chem Duty
Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.
Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing marking.
Motor Horsepower: 1
Voltage: 230/460
Phase: 3
Frequency: 60 Hz
Synchronous Speed: 3450 rpm (maximum)
Service Factor: ☐ 1.0 ☒ 1.15
Mounting Type: ☒ Horizontal ☐ Vertical
Enclosure Type: TEFC
Material: Ductile Iron w/ ETFE lining
Load Class:
☐ Multispeed, Two speed: _____ rpm
☐ Variable Frequency Drive: See Division 26 – Electrical. Provide Inverter Duty Rated Motors.
Windings: ☐ One ☐ Two ☒ Thermal protection embedded in windings
Motor nameplate horsepower shall not be exceeded at any operational point.
Provide: ☐ Space Heater ☐ Oversize main terminal (conduit) box for motors
☐ Moisture detection switches

SPECIAL FEATURES/NOTES

See Division 26 and Division 40 for general instrumentation and control requirements.

Suggested models are for reference only. Other models meeting the design criteria will be considered.

Contractor to provide required total dynamic head (TDH) after temporary chemical setup is designed.

END OF SECTION

SECTION 43 41 45 - FIBERGLASS REINFORCED PLASTIC TANKS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section includes the Work necessary to furnish and install complete, the Filament-Wound Fiberglass Reinforced Plastic (FRP) tanks including all related equipment, material, and appurtenances.

1.2 GENERAL

A. Equipment Numbers: See Tank Data Sheets at the end of the section.

B. Like items of equipment provided hereinafter shall be the end products of one Manufacturer to achieve standardization of appearance, operation, maintenance, spare parts, and Manufacturer's services.

C. Unit Responsibility: The Work requires that the FRP tanks, complete with all accessories and appurtenances, be the end product of one responsible Manufacturer. The Manufacturer shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features and functions without altering or modifying the Contractor's responsibilities under the Contract Documents. The Contractor is responsible to the Owner for providing the systems as specified herein.

D. The equipment specified herein is included in the MANUFACTURER/ SUBCONTRACTOR Form. Refer to the Bid Form and the Instructions to Bidders for additional requirements.

1.3 REFERENCES

A. Refer to the following:
1. ASTM D-3299 Filament Wound Glass Fiber Reinforced Polyester Chemical Resistant Tanks.
2. ASTM D-4097 Standard Specification for Contact-Molded Glass Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks
3. ASTM D-883 Definitions of Terms Relating to Plastics.
4. ASTM D-2583 Test for Indentation Hardness of Rigid Plastics by Means of Barcol Impressere.
5. ASTM D-2563 Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
6. ASME RTP-1 Reinforced Thermoset Plastic Corrosion Resistant Equipment.
7. American National Standards Institute (ANSI): B16.5, Pipe Flanges and Flanged Fittings.
8. American Society for Testing and Materials (ASTM):
   a. C582, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion Resistant Equipment.
9. D2584, Standard Test Method for Ignition Loss of Cured Reinforced Resins.

1.4 DEFINITIONS

A. FRP: Fiberglass Reinforced Plastic.

1.5 DESIGN REQUIREMENTS

A. Design the tanks according to Article REFERENCES of this Section.

B. Design tank, including resin selection, wall thickness, methods and location of support, and stiffener requirements. Design shall be prepared and sealed by designer meeting requirements of Article QUALITY ASSURANCE of this Section.

C. All tanks are to have a domed roof finished with a non-slip surface created by a heavy sprinkling of sand into the surface of the final surface resin coating.

1.6 SUBMITTALS

A. The following specific information shall be provided:
   1. Shop Drawings:
      a. Complete Manufacturer's descriptive information and shop drawings for all equipment, material, complete resin system information, and detailed fabrication drawings, and devices furnished.
      b. Catalog information and cuts for all manufactured items, highlighted to show actual items proposed to be provided.
      c. Tank data indicating equipment number, pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, corrosion barrier thickness, and details of nozzle designs.
      d. All dimensions and locations of all major elements of the FRP tanks and their accessories, critical clearance requirements, and support dimension requirements.
      e. Shop drawings or equipment drawings, including the location of connections to other work, material list, and empty and operating weights of the tanks.
      f. Installation or placing drawings for equipment, and installation requirements including location of anchors, and piping connections.
      g. Submit results of tests specified in Article FACTORY TESTING in this Section.
      h. Tank capacity chart indicating gallons for each inch of depth and cumulative total from bottom.
      i. Fabricator's detailed requirements for anchor bolts.
      j. Recommended bolt torques for all bolted FRP connections.
   2. Quality Control Submittals:
      a. Fabricator's Certificate of Compliance with fabrication requirements.
      b. Resin Manufacturer's Certification of resin for intended service.
      c. Qualifications of fabricator's Quality Assurance Supervisor.
      d. Copy of the fabricator's Quality Assurance Program.
      e. Quality Assurance Inspection:
      f. Qualifications of independent FRP Quality Assurance Inspector.
      g. Initial QA Inspection Report.
      h. Certification of Factory Testing.
      i. Special shipping, storage and protection, and handling instructions.
      j. Fabricator's printed installation and tank support instructions.
      k. Manufacturer's Certificate of Proper Installation.
      l. Drawings and other information required in Article DESIGN REQUIREMENTS of this Section.
      m. Suggested spare parts list to maintain the equipment in service for a period of 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
      n. List of special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

1.7 OPERATION AND MAINTENANCE DATA

A. Operation and Maintenance
   1. The equipment system manufacturer shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain all equipment supplied by the manufacturer. Instructions shall assume the operator is

familiar with pumping equipment, but he/she has not previously operated and/or maintained the exact equipment supplied.

2. The instruction shall be prepared as a system manual applicable solely to the equipment supplied by the manufacturer and shall include those devices and equipment supplied by him.
3. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications.

1.8 QUALITY ASSURANCE

A. Fabricator's Qualifications: Provide an independent certified Quality Assurance Supervisor of minimum 10 years of experience in the design and manufacture of similar tanks.
   1. Provide a certificate of experience.
   2. Provide 5 project names – including owner, address, contact person, telephone number – for tanks designed and manufactured by fabricators that have been in service for more than 5 years.

B. Fabricator's Quality Assurance Supervisor:
   1. Minimum 5 years' experience as an FRP inspector.

C. Designer: Registered Professional Engineer.

1.9 WARRANTY

A. Provide warranty for a period of 12 months after the final acceptance of the equipment by the Owner and Engineer, but no later than 18 months after delivery. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.

B. Spare parts identified within this specification shall not be used to address warranty repairs.

1.10 SEQUENCING AND SCHEDULING

A. Tanks/Vessels shall not be shipped from the factory until the Engineer's review of Certification of Factory Testing is completed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Some specific requirements relative to this section are attached as supplements at the end of the section.

2.2 MANUFACTURERS

A. Manufacturers:
   1. Diamond Fiberglass
   2. Tanksystems LLC.
   3. EcoVerde
   4. Belding Tank
   5. Or Equal.

Where Manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein.

2.3 SERVICE CONDITIONS

A. Risk Category III. Seismic Design Category B. SDS=0.142, SD1=0.116

B. Normal Operating Pressure: Atmospheric.

C. Instantaneous Pressure:
   1. Pressure: 3 psig.
   2. Vacuum: -0.01 psig.

D. See Tank Data Sheets for additional information.

2.4 MATERIALS

A. Filaments-Wound: According to ASTM D-3299-88, Grade 1.

B. Closed Top: Head knuckle radius minimum 1.5"

C. Flat Bottom:
   1. Bottom Knuckle Radius: Minimum 1.5".
   2. Extend reinforcement of the knuckle-radius area up the vertical wall a minimum of 8" on tanks to 4' diameter and 12" for tanks over 4' in diameter.

D. Resin:
   1. Suitable for the intended service.
   2. Liner Resin: Premium grade vinyl ester resin, Dow Chemical Co. - Derakane 411**,** Ashland Chemical Co. - Hetron 922, or approved equal.
   3. Use the same resin throughout the tank shell. Dual resin systems shall not be acceptable.
   4. No dyes, pigments, or colorants except as follows:
      a. Ultraviolet absorbers shall be added to the exterior surface of all tanks.
      b. A pigmented exterior gel coat shall be provided when required on the Tank Data Sheets.
   5. The resin shall not contain fillers or thixotropic agents.
   6. Curing System:
      a. As recommended by resin Manufacturer.
      b. Cure all products to a minimum of 90% of the minimum Barcol hardness specified by resin Manufacturer.
      c. Measure Barcol hardness according to ASTM D-2583-87.
   7. Tanks shall be post-cured. Post-cure the tank and appurtenances in accordance with resin Manufacturer's recommendation for time and temperature. Post-curing shall be completed with warm-to-hot dry air, free of combustion products. Hot spots shall be avoided.

E. Reinforcement:
   1. Veil: Synthetic surface veil (Nexus - Burlington Industries, or approved equal), with finish and a binder compatible with the lay-up resin.
   2. Interior Layer: A resin-rich interior surface of 100 to 120 mils using chopped strand mat backing the veil. Use no additive in the corrosion barrier.
   3. Chopped Strand Mat: Type E glass, minimum 1-1/2 ounces per square foot, with silane finish and styrene soluble binder.
   4. Continuous roving used in chopper gun for spray-up: Type E glass.

5. Woven Roving: Type E glass, nominal 24 ounces per square yard, 4 by 5 weave, with silane type finish.
6. Continuous roving used for filament winding: Type E glass with a silane type finish, with a nominal yield of at least 250 strand yards per pound.

2.5 FABRICATION REQUIREMENTS

A. General
1. Tanks shall be chop-hoop filament wound fabrication. Filament wound shall confirm to ASTM Specification D3299-95a, "Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks".

B. Closed Top:
1. Head Knuckle Radius: Minimum 1.5 inch
2. All tanks shall have a domed roof finished with a non-slip surface created by a heavy sprinkling of sand into the surface of the final surface resin coating.

C. Flat Bottom:
1. Bottom Knuckle Radius: Minimum 1.5 inch
2. Extend reinforcement of the knuckle-radius area up the vertical wall a minimum of 8 inches on tanks to 4 feet diameter and 12 inches for tanks over 4 feet in diameter.

D. Laminate:
1. Laminate consists of inner surface and interior layer (together constitute the corrosion barrier), exterior layer (structural layer), and outside surface.
2. Meet the requirements of the mechanical properties and visual acceptance criteria in accordance with ASTM D-2563-87, Level II on tank interior and Level III for outside surfaces.
3. Inner Surface: Reinforce inner surface with a resin-rich surfacing veil of at least 20 mils thick. The inner surface shall have a minimum of 2 plies of veil. The resin content of the inner surface shall be a minimum of 85% by weight.
4. Interior Layer: Construct the interior layer of resin reinforced with a minimum of 2 plies of chopped strand mat. The thickness of the interior layer shall not be less than 100 mils thick.
5. Corrosion Barrier: Glass content of combined inner surface and interior layer shall be 27% ±5%. The corrosion barrier shall be considered non-structural for all design aspects.
6. Exterior or structural layer:
    a. Hand Lay-up (heads, joints, fittings): Alternating layers of chopped strand E-glass or equivalent chopped glass and woven roving. Glass content for hand lay-up layers shall be 30% to 45%.
    b. Filament Wound: Chop-hoop filament winding with continuous strand roving to provide a glass content of 50% to 80%.
7. Marking:
    a. Each tank shall be identified with:
    b. Equipment Identification (TAG) number.
    c. Resin.
    d. Chemical to be Stored Including:
    e. Concentration.
    f. Specific gravity.
    g. pH.
    h. Design pressure/vacuum.
    i. Tank wall and head minimum thickness.
    j. Tank capacity, total and usable.
    k. Tank design temperature.
    l. Date of manufacture.
    m. Manufacturer name and addresses.

n. Provide permanent, visible marking. Seal decals, labels, etc, into the laminate exterior with clear resin.

E. Nozzles:
1. All flanged nozzles shall be hand lay-up construction with the pipe stub molded integrally with the pipe flange. Compression molded or cemented on flanges are prohibited. The resin used for the inner surface and interior layer of flanged stubs shall have the same resin cure system as the tank.
2. Nozzles shall be gusseted with conical or plate type gussets. Plate gussets shall be suitably laminated to the flange back side, hub, pipe neck, and tank wall
3. Nozzles shall be finished flush with the inside surface of the tank, unless indicated otherwise.
4. Provide two gaskets for each nozzle. Gaskets shall be 1/8" thick full-face elastomeric material having a hardness of Shore A60 ±5. Gasket material shall be suitable for the intended service.
5. All flanged nozzles shall be rated at 100 psi with dimensions and bolting corresponding to ANSI B16.3-88 for 150 lb. steel flanges.
6. The back face of all flanges shall be spot-faced, flat and parallel to the flange face of sufficient diameter to accept an SAE metal washer under the bolt head or nut.
7. Nozzles shall have a 6" projection as measured from the face of the flange to the tank exterior surface, to allow insertion of flange bolts pointed away from the tank.

F. Manways: Flanged manways shall be provided as indicated on the Tank Data Sheets.
1. Flanged manways shall be provided with full-face Garlock or Gore-Tex Expanded PTFE gaskets, 40 to 60 Durometer and 1/4-inch minimum thickness.
2. Flange dimensions, including bolting pattern, shall be as required for design pressures stated hereinbefore. In addition, minimum thickness for all man-way flanges shall meet or exceed requirements of ASTM D-3299 for side entry man-ways.
3. Manway bolts and hardware shall be FRP or 316 Stainless-steel.
4. The area directly surrounding man-way nozzles shall have a double, reinforcing plate installed.

2.6 APPURTENANCES

A. Supports:
1. Pipe Supports:
a. Provide for all tank overflow pipes and loading pipes, as required.
b. Spacing of supports shall be as recommended by the fabricator but shall not be greater than 4' center to center and shall allow removal of the pipe.
c. Provide FRP supports complete with necessary bolts, nuts, and washers.
2. Provide lifting lugs suitably attached for all tanks weighing over 100 pounds.
3. Anchor Bolts: Type 316, stainless steel bolts, sized by fabricator and at least 1/2" in diameter, or as shown and as specified in Section 05 50 00, METAL FABRICATIONS.
4. Anchor Bolt Clips: Provide minimum of four equally spaced anchor bolt clips on each tank. The anchor bolt clips to be fabricated from FRP or TYPE 316 stainless steel.
5. Safety Devices: The completed work shall include all necessary permanent safety devices, required by OSHA, and other Federal, State, and local health and safety regulations.

2.7 SOURCE QUALITY CONTROL

A. Provide services of an independent FRP testing inspector to be present at the point of manufacture at the time fabrication is started, to perform the following:
1. Observe manufacturing methods, machinery, and techniques to assure compliance with industry standards and these specifications.
2. Observe initial fabrication to verify compliance with these specifications.
3. Observe quality control methods for mixing resins and testing of completed equipment.

4. Generally observe quality of other, ongoing fabrication.
5. Prepare an Initial QA Inspection Report.

B. Upon completion of fabrication and prior to shipment, the independent FRP testing inspector shall perform or witness the following:
1. Visual inspection to the requirements of ASTM D-2563-87.
2. Barcol Hardness measurements per ASTM D-2583-87.
3. Acetone sensitivity test for all internal secondary bonds.
4. Glass content by ignition loss on three cutouts per ASTM D-2584.
5. Hydrostatic Leak Test:
   a. Perform on all tanks.
   b. Fill to top nozzle; allow it to stand for 2 hours with no visible leakage.
6. Repairs deemed acceptable by the independent FRP testing inspector must be approved by Engineer. Provide service records for repairs performed during construction.
7. Identify and retain all cutouts. The engineer may select certain cutouts for testing for physical properties of the laminate.
8. Factory Test Reports: Certify and sign the results of the following: Inspections.
9. Results of hydrostatic testing.
10. Test Reports of physical properties of standard laminates.

PART 3 - EXECUTION

3.1 GENERAL

A. The equipment specified herein shall be located as shown on the Drawings and installed in conformance with the Manufacturer's suggested method as approved. The tanks shall be adequately protected as work is accomplished around the tanks.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00, PRODUCT REQUIREMENTS. In addition, prepare and protect the tank for shipment as follows:
1. Mount tanks on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.
2. Protect all flanged nozzles with wooden blinds bolted to the flange and having a diameter of 2" greater than the outside diameter of the flange.
3. Provide either rigid plugs inside the ends to prevent deflection or wooden boxes for all un-flanged components. Brace the open ends of tanks with a suitable stiffening member to prevent deflection.
4. Do not ship components or other pieces loose inside the tanks.
5. Load tanks with at least 2" clearance between the tank (including fittings) and the bulk heads or bed of the vehicle.
6. Regardless of the mode of transportation, firmly fasten and pad all components to prevent shifting of the load or flexing of components while in transit.
7. Storage: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

3.3 INSTALLATION

A. The intent of this Section is to advise the installing Contractor of certain mandatory requirements which must be accomplished during installation of Fiberglass Reinforced Plastic (FRP) tanks. It is not intended to be used as a sole specification governing the installations, but only to communicate certain assumptions used in the design of the vessels.

B. In accordance with the Manufacturer's written instructions.

C. Accurately place anchor bolts using templates furnished by the Manufacturer.

D. The vessel foundation must provide full non-elastic support to the flat bottom preferably through the use of wet grout, which will allow continuous support even though surfaces may not be flat.

E. Prior to tightening anchor bolts, hard shims must be installed under all anchor lugs, completely filling the void between the lug and foundation.

F. Unless otherwise agreed, all piping and ducting shall be independently supported, so as not to apply loads to the vessel nozzles. Potential loads due to thermal expansion of piping should also be isolated from the vessel. During installation, do not force piping into alignment; this can create excessive stresses in the tank.

G. Do not mate raised face flanges or ring gaskets to full faced FRP nozzles.

H. Where tank foundations are cutout to accommodate full bottom drains, after tank installation the cutout area shall be backfilled with grout or other material that will provide localized support.

3.4 FIELD QUALITY CONTROL

A. Functional Test:
   1. Conduct on each tank.
   2. Hydrostatic leak test with the tank full of clean water. Allow water to stand for 24 hours. No leakage permitted.

3.5 MANUFACTURERS' SERVICES

A. A Manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed for the services herein under, travel time excluded:
   1. (2) person-days for installation assistance, inspection, and certification of the installation. Provide certificate.
   2. (1) person-day for pre-startup classroom or job site training of Owner's personnel.

B. Training of Owner's personnel shall be at such times and at such locations as requested by Owner.

C. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.6 SUPPLEMENTS

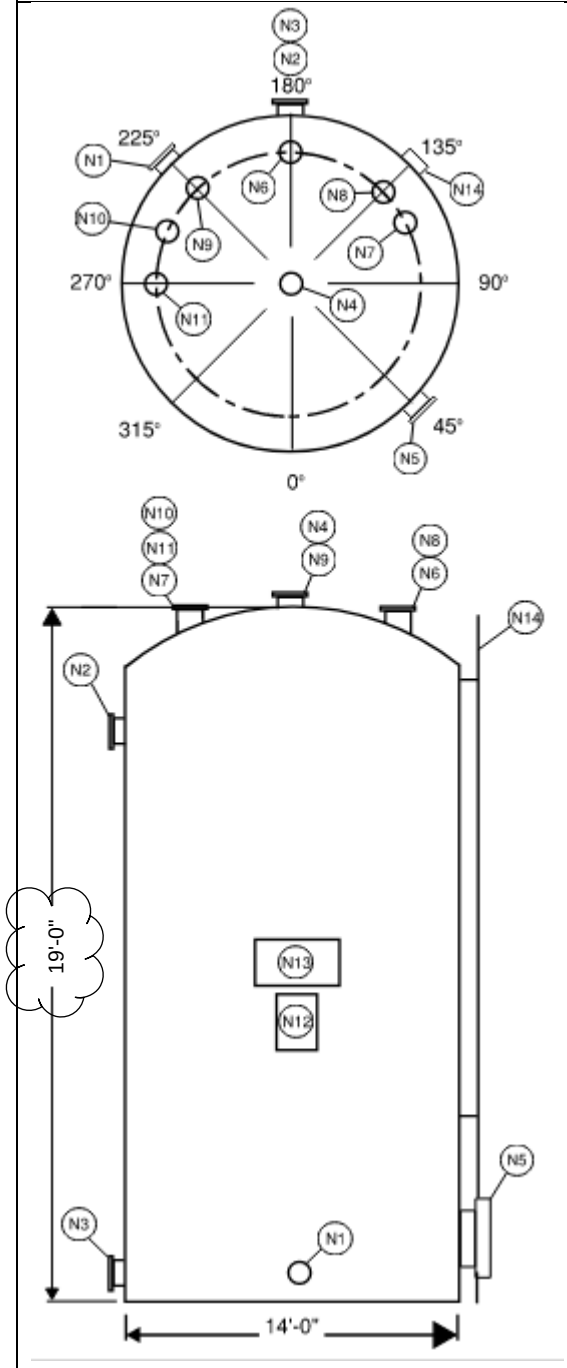
A. The supplements listed below are part of this Specification.
   1. 43 41 16.1

GARVER
TANK DATA SHEET

Tank Equipment No. FTK10, FTK11, FTK12

APPLICABLE TO:
- ■ PROPOSAL
- ☐ PURCHASE
- ☐ RECORD

Information not specified to be supplied by vendor as applicable



GENERAL INFORMATION

Chemical: 50% Sodium Hydroxide (Caustic Soda)		
Working Capacity: 18,900 GAL		Location: INDOORS
Design Code: ASTM / ASME		Roof: DOMED
Material: FRP		Shell: VERT CYL
Liquid Temp: 50 - 120 °F		Bottom: SLOPED TO OUTLET
COATING	EXTERNAL	INTERNAL
Surface Prep		
Primer		
Finish Coat		
Insulation Thk		
Material (Resin)	Vinyl Ester	Vinyl Ester
Cladding		

NOZZLE SCHEDULE

MK	Size/Type	Service	Projection	Radial CL
N1	3" FLG	OUTLET (NOTE 3)	6"	SIDE
N2	4" FLG	OVERFLOW (NOTE 2)	6"	SIDE
N3	3" FLG	DRAIN	6"	SIDE
N4	4" FLG	VENT	6"	TOP/CENTER
N5	24"	MANWAY	6"	SIDE
N6	3" FLG	FILL		TOP
N7	8" FLG	INSPECTION WITH HINGED COVER	6"	TOP
N8	4" FLG	LEVEL SENSOR	6"	TOP
N9	3" FLG	WATER FILL	6"	SIDE
N10	1" FLG	LEVEL GAUGE (NOTE 5)	3"	SIDE
N11	6" FLG	RECIRCULATION INLET	6"	TOP
N12		MANUFACTURER NAME PLATE		SIDE
N13		CHEMICAL LABEL		SIDE
N14		LADDER		SIDE

ACCESSORIES

Level Indicator	X	Exterior Pigmented Gel Coat	
Ladder ☐ Int ■ Ext	X	Inlet Baffle	
Stairs		Lifting Lugs	X
Walkway		Thief Hatch	
Platform Clips ☐		Access Manways	X
Volume Level Tape	X	Anchor Lugs	X
Down Corner ☐ Int ☐ Ext		Syphon Drain	
Insulate		Visual Liquid Level Gauge	X
Heat Trace			
Design Maintain (Min) Temp:			
High Limit (Cut-Off) Temp:			

NOTES:

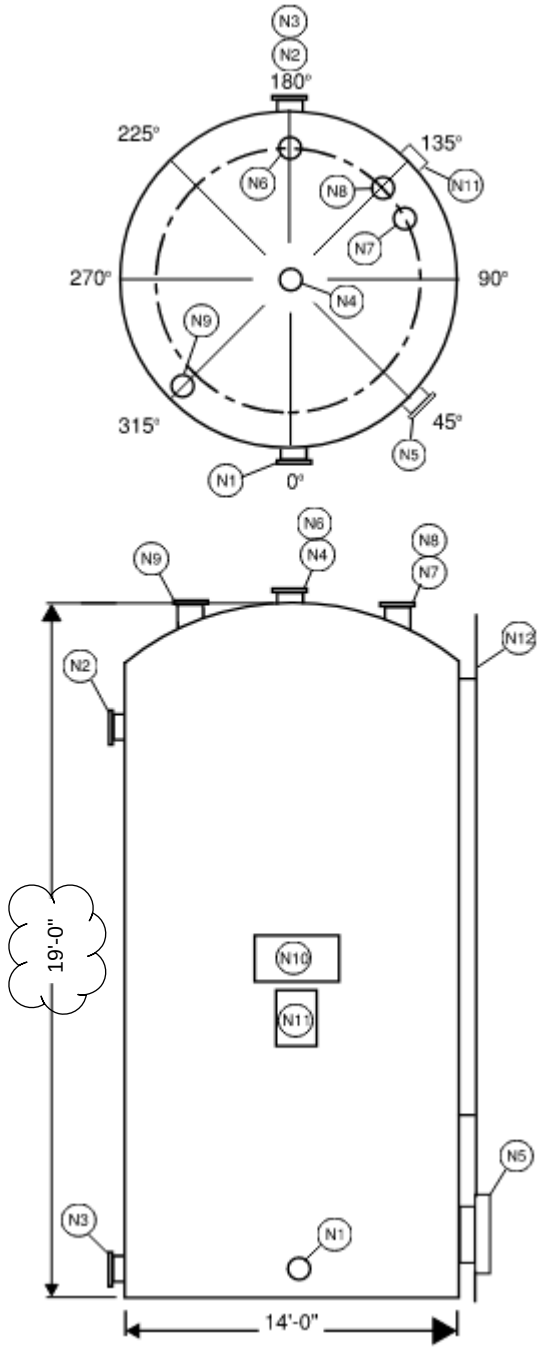
1. SEE SPECIFICATIONS FOR ADDITIONAL INFO.
2. TANK HEIGHT ON DIAGRAM IS MAXIMUM TANK HEIGHT.
3. EXTEND FILL LINE (N6) TO 12” FROM TANK BOTTOM. INTERNAL DROP PIPES TO HAVE ANTI-SIPHON FITTINGS . PROVIDE INTERNAL SUPPORTS.
4. WORKING CAPACITY IS TO THE BOTTOM OF THE OVERFLOW OUTLET. OVERFLOW OUTLET INVERT TO BE LOCATED AT 16’-6” FROM BOTTOM OF TANK.
5. OUTLET (N1) SHALL BE LOCATED AT INVERT OF TANK.
6. ALL NOZZLES SHALL BE CONICAL GUSSET NOZZLE LOCATION IN THE ELEVATION
7. EXTERIOR VISUAL LEVEL GAUGE TO BE REVERSE FLOAT LEVEL GAUGE
8. VIEW MAY BE ROTATED FOR CLARITY AND DIMENSIONING
9. REFERENCE DRAWINGS FOR TRUE TANK AND FITTING ORIENTATION

GARVER
TANK DATA SHEET

Tank Equipment No. FTK01, FTK02, FTK03

APPLICABLE TO:
- ■ PROPOSAL
- ☐ PURCHASE
- ☐ RECORD

Information not specified to be supplied by vendor as applicable



GENERAL INFORMATION

Chemical: 50% Aluminum Chlorohydrate (ACH)		
Working Capacity: 18, 900 GAL		Location: Indoors
Design Code: ASTM / ASME		Roof: DOMED
Material: FRP		Shell: VERT CYL
Ambient Temp: 20 - 90 °F		Bottom: SLOPED TO OUTLET
COATING	EXTERNAL	INTERNAL
Surface Prep		
Primer		
Finish Coat		
Insulation Thk		
Material (Resin)	Vinyl Ester	Vinyl Ester
Cladding		

NOZZLE SCHEDULE

MK	Size/Type	Service	Projection	Radial CL
N1	3" FLG	OUTLET (NOTE 3)	6"	SIDE
N2	4" FLG	OVERFLOW (NOTE 2)	6"	SIDE
N3	3" FLG	DRAIN	6"	SIDE
N4	4" FLG	VENT	6"	TOP/CENTER
N5	24"	MANWAY	6"	SIDE
N6	3" FLG	FILL		TOP
N7	8" FLG	INSPECTION WITH HINGED COVER	6"	TOP
N8	4" FLG	LEVEL SENSOR	6"	TOP
N9	1" FLG	LEVEL GAUGE (NOTE 5)	3"	SIDE
N10		MANUFACTURER NAME PLATE		SIDE
N11		CHEMICAL LABEL		SIDE
N12		LADDER		SIDE

ACCESSORIES

Level Indicator	X	Exterior Pigmented Gel Coat	
Ladder ☐ Int ■ Ext	X	Inlet Baffle	
Stairs		Lifting Lugs	X
Walkway		Thief Hatch	
Platform Clips ☐		Access Manways	X
Volume Level Tape	X	Anchor Lugs	X
Down Corner ☐ Int ☐ Ext		Syphon Drain	
Insulate		Visual Liquid Level Gauge	X
Heat Trace			
Design Maintain (Min) Temp:			
High Limit (Cut-Off) Temp:			

NOTES:

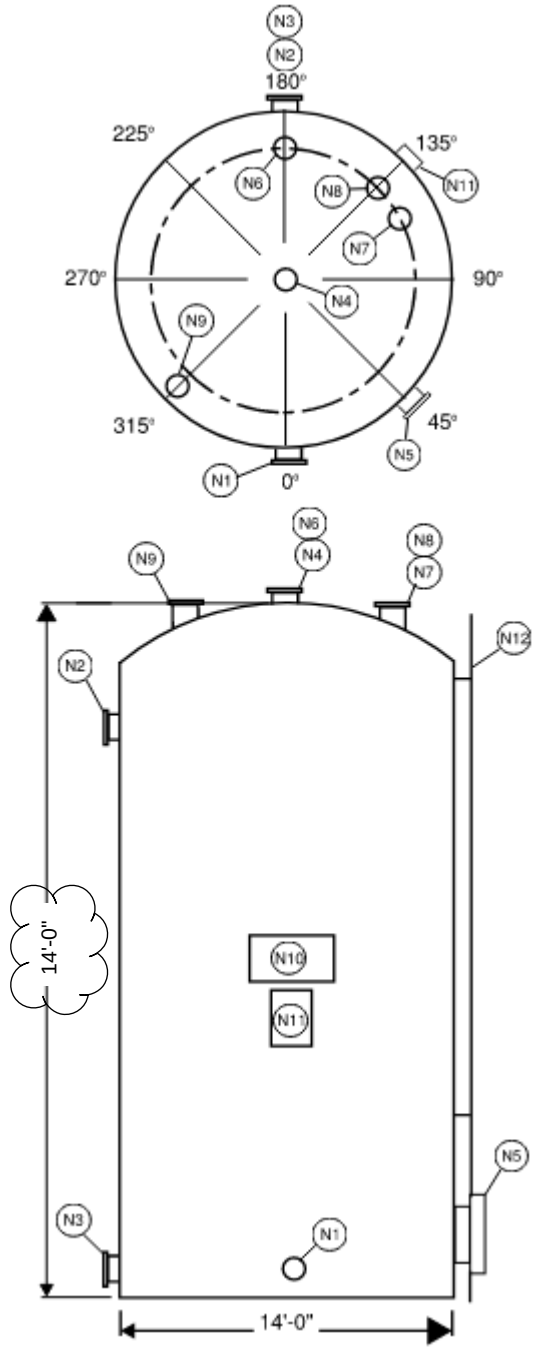
1. SEE SPECIFICATIONS FOR ADDITIONAL INFO.
2. TANK HEIGHT ON DIAGRAM IS MAXIMUM TANK HEIGHT.
3. EXTEND FILL LINE (N6) TO 12" FROM TANK BOTTOM. INTERNAL DROP PIPES TO HAVE ANTI-SIPHON FITTINGS . PROVIDE INTERNAL SUPPORTS.
4. WORKING CAPACITY IS TO THE BOTTOM OF THE OVERFLOW OUTLET. OVERFLOW OUTLET INVERT TO BE LOCATED AT 16'-6" FROM BOTTOM OF TANK.
5. OUTLET (N1) SHALL BE LOCATED AT INVERT OF TANK.
6. ALL NOZZLES SHALL BE CONICAL GUSSET NOZZLE LOCATION IN THE ELEVATION
7. EXTERIOR VISUAL LEVEL GAUGE TO BE REVERSE FLOAT LEVEL GAUGE
8. VIEW MAY BE ROTATED FOR CLARITY AND DIMENSIONING
9. REFERENCE DRAWINGS FOR TRUE TANK AND FITTING ORIENTATION

GARVER
TANK DATA SHEET

Tank Equipment No. FTK08

APPLICABLE TO:
- ■ PROPOSAL
- ☐ PURCHASE
- ☐ RECORD

Information not specified to be supplied by vendor as applicable



GENERAL INFORMATION

Chemical: 25% Hydrofluorsilicic Acid (HFS)		
Working Capacity: 12, 600 GAL		Location: Indoors
Design Code: ASTM / ASME		Roof: DOMED
Material: FRP		Shell: VERT CYL
Ambient Temp: 20 - 90 °F		Bottom: SLOPED TO OUTLET
COATING	EXTERNAL	INTERNAL
Surface Prep		
Primer		
Finish Coat		
Insulation Thk		
Material (Resin)	Vinyl Ester	Vinyl Ester
Cladding		

NOZZLE SCHEDULE

MK	Size/Type	Service	Projection	Radial CL
N1	3" FLG	OUTLET (NOTE 3)	6"	SIDE
N2	4" FLG	OVERFLOW (NOTE 2)	6"	SIDE
N3	3" FLG	DRAIN	6"	SIDE
N4	4" FLG	VENT	6"	TOP/CENTER
N5	24"	MANWAY	6"	SIDE
N6	3" FLG	FILL		TOP
N7	8" FLG	INSPECTION WITH HINGED COVER	6"	TOP
N8	4" FLG	LEVEL SENSOR	6"	TOP
N9	1" FLG	LEVEL GAUGE (NOTE 5)	3"	SIDE
N10		MANUFACTURER NAME PLATE		SIDE
N11		CHEMICAL LABEL		SIDE
N12		LADDER		SIDE

ACCESSORIES

Level Indicator	X	Exterior Pigmented Gel Coat	
Ladder ☐ Int ■ Ext	X	Inlet Baffle	
Stairs		Lifting Lugs	X
Walkway		Thief Hatch	
Platform Clips ☐		Access Manways	X
Volume Level Tape	X	Anchor Lugs	X
Down Corner ☐ Int ☐ Ext		Syphon Drain	
Insulate		Visual Liquid Level Gauge	X
Heat Trace			
Design Maintain (Min) Temp:			
High Limit (Cut-Off) Temp:			

NOTES:

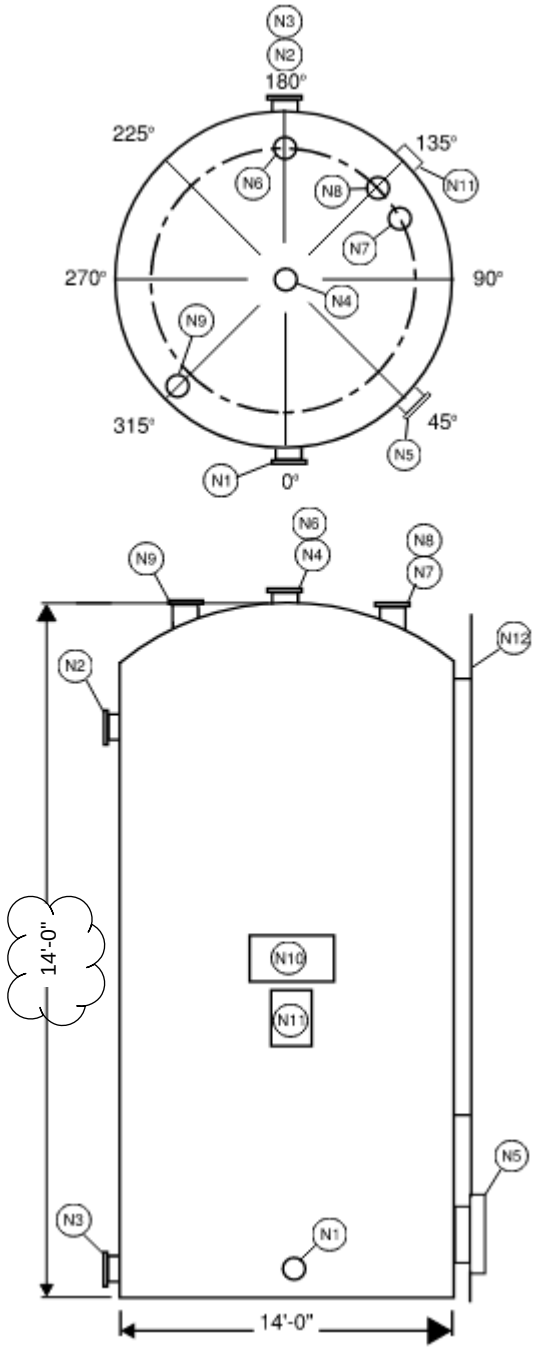
1. SEE SPECIFICATIONS FOR ADDITIONAL INFO.
2. TANK HEIGHT ON DIAGRAM IS MAXIMUM TANK HEIGHT.
3. EXTEND FILL LINE (N6) TO 12” FROM TANK BOTTOM. INTERNAL DROP PIPES TO HAVE ANTI-SIPHON FITTINGS . PROVIDE INTERNAL SUPPORTS.
4. WORKING CAPACITY IS TO THE BOTTOM OF THE OVERFLOW OUTLET. OVERFLOW OUTLET INVERT TO BE LOCATED AT 11’-0” FROM BOTTOM OF TANK.
5. OUTLET (N1) SHALL BE LOCATED AT INVERT OF TANK.
6. ALL NOZZLES SHALL BE CONICAL GUSSET NOZZLE LOCATION IN THE ELEVATION
7. EXTERIOR VISUAL LEVEL GAUGE TO BE REVERSE FLOAT LEVEL GAUGE
8. VIEW MAY BE ROTATED FOR CLARITY AND DIMENSIONING
9. REFERENCE DRAWINGS FOR TRUE TANK AND FITTING ORIENTATION

GARVER
TANK DATA SHEET

Tank Equipment No. FTK06

APPLICABLE TO:
- ■ PROPOSAL
- ☐ PURCHASE
- ☐ RECORD

Information not specified to be supplied by vendor as applicable



GENERAL INFORMATION

Chemical: Clarifloc C-378 Cationic Polymer		
Working Capacity: 12, 600 GAL		Location: Indoors
Design Code: ASTM / ASME		Roof: DOMED
Material: FRP		Shell: VERT CYL
Ambient Temp: 20 - 90 °F		Bottom: SLOPED TO OUTLET
COATING	EXTERNAL	INTERNAL
Surface Prep		
Primer		
Finish Coat		
Insulation Thk		
Material (Resin)	Vinyl Ester	Vinyl Ester
Cladding		

NOZZLE SCHEDULE

MK	Size/Type	Service	Projection	Radial CL
N1	3" FLG	OUTLET (NOTE 3)	6"	SIDE
N2	4" FLG	OVERFLOW (NOTE 2)	6"	SIDE
N3	3" FLG	DRAIN	6"	SIDE
N4	4" FLG	VENT	6"	TOP/CENTER
N5	24"	MANWAY	6"	SIDE
N6	3" FLG	FILL		TOP
N7	8" FLG	INSPECTION WITH HINGED COVER	6"	TOP
N8	4" FLG	LEVEL SENSOR	6"	TOP
N9	1" FLG	LEVEL GAUGE (NOTE 5)	3"	SIDE
N10		MANUFACTURER NAME PLATE		SIDE
N11		CHEMICAL LABEL		SIDE
N12		LADDER		SIDE

ACCESSORIES

Level Indicator	X	Exterior Pigmented Gel Coat	
Ladder ☐ Int ■ Ext	X	Inlet Baffle	
Stairs		Lifting Lugs	X
Walkway		Thief Hatch	
Platform Clips ☐		Access Manways	X
Volume Level Tape	X	Anchor Lugs	X
Down Corner ☐ Int ☐ Ext		Syphon Drain	
Insulate		Visual Liquid Level Gauge	X
Heat Trace			
Design Maintain (Min) Temp:			
High Limit (Cut-Off) Temp:			

NOTES:

1. SEE SPECIFICATIONS FOR ADDITIONAL INFO.
2. TANK HEIGHT ON DIAGRAM IS MAXIMUM TANK HEIGHT.
3. EXTEND FILL LINE (N6) TO 12” FROM TANK BOTTOM. INTERNAL DROP PIPES TO HAVE ANTI-SIPHON FITTINGS . PROVIDE INTERNAL SUPPORTS.
4. WORKING CAPACITY IS TO THE BOTTOM OF THE OVERFLOW OUTLET. OVERFLOW OUTLET INVERT TO BE LOCATED AT 11’-0” FROM BOTTOM OF TANK.
5. OUTLET (N1) SHALL BE LOCATED AT INVERT OF TANK.
6. ALL NOZZLES SHALL BE CONICAL GUSSET NOZZLE LOCATION IN THE ELEVATION
7. EXTERIOR VISUAL LEVEL GAUGE TO BE REVERSE FLOAT LEVEL GAUGE
8. VIEW MAY BE ROTATED FOR CLARITY AND DIMENSIONING
9. REFERENCE DRAWINGS FOR TRUE TANK AND FITTING ORIENTATION

END OF SECTION

See Division 26 and Division 40 for general instrumentation and control requirements.

Suggested models are for reference only. Other models meeting the design criteria will be considered.

Contractor to provide required total dynamic head (TDH) after temporary chemical setup is designed.

END OF SECTION

SUMMARY OF PAY ITEMS

ITEM NUMBER	SPEC NUMBER	ITEM DESCRIPTION	PAY NOTES	UNIT	QUANTITY
BASE BID MOHAWK WTP CHEMICAL TANK REPLACEMENT					
1	SPECIAL	ALL WORK AS DEFINED IN THE CONTRACT DOCUMENTS, EXCEPT THOSE ITEMS LISTED SEPARATELY BELOW	1	EA	1
2	02 41 00	DEMOLITION	3	EA	1
3	43 41 45	18,900 GALLON 50% SODIUM HYDROXIDE FIBERGLASS REINFORCED PLASTIC TANKS	3	EA	3
4	43 41 45	18,900 GALLON 50% ALUMINUM CHLOROHYDRATE FIBERGLASS REINFORCED PLASTIC TANKS	3	EA	3
5	43 41 45	12,600 GALLON 25% HYDROFLUORSILICIC ACID FIBERGLASS REINFORCED PLASTIC TANKS	3	EA	1
6	43 41 45	12,600 GALLON CATIONIC POLYMER FIBERGLASS REINFORCED PLASTIC TANKS	3	EA	1
7	43 41 43	500 GALLON 50% SODIUM HYDROXIDE POLYETHYLENE UPRIGHT STORAGE TANK	3	EA	2
8	40 72 23	RADAR LEVEL METERS	3	EA	8
9	40 73 45	WEIGHT SCALES	3	EA	2
10	43 42 56	SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMPS	3	EA	3
11	SPECIAL	ELECTRICAL IMPROVEMENTS	3	EA	1
12	40 68 63	DCS AND OWS PROGRAMMING	3	EA	1
13	COT 303	MOBILIZATION/DEMOBILIZATION	2	EA	1
14	01 20 00	CHEMICAL ALLOWANCE	3, 4	ALLOW	$245,000.00
15	SPECIAL	OWNER ALLOWANCE	5	ALLOW	$125,000.00
ADDITIVE ALTERNATE NO. 1 MOHAWK WTP CHEMICAL TANK REPLACEMENT					
16	01 23 00	ADD ALTERNATE NO. 1 - SODIUM HYDROXIDE TRENCH CLEANING AND COATING	3	EA	1

PAY ITEM NOTES:

1. INCLUDES ALL WORK REQUIRED AT THE 3600 E. MOHAWK BLVD. CHEMICAL STORAGE FACILITY THAT IS NOT SPECIFICALLY ADDRESSED BY A SEPARATE PAY ITEM.
2. ITEM INCLUDES THE WORK AS DESCRIBED IN THE CITY OF TULSA STANDARD SPECIFICATION AND WILL BE PAID FOR AS DESCRIBED IN THE CITY OF TULSA STANDARD SPECIFICATION.
3. ITEM INCLUDES THE WORK DESCRIBED IN THE SUPPLEMENTARY SPECIFICATIONS AND PLANS AND SHALL BE PAID FOR ON A UNIT BASIS ACCORDING TO THE BID AMOUNT.
4. CHEMICAL ALLOWANCE FOR USE BY THE CITY OF TULSA FOR THE PURCHASE OF CHEMICALS FOR THE TEMPORARY CATIONIC POLYMER AND HYROFLUOROSILICIC ACID SYSTEM.
5. THE "OWNER ALLOWANCE" CAN BE USED FOR VARIOUS WORK AND MISCELLANEOUS ITEMS NOT IDENTIFIED IN THE CONTRACT DOCUMENTS WITH THE FOLLOWING PROVISIONS:

A. THE ALLOWANCE SHALL BE USED FOR THE COST OF MATERIALS, LABOR, INSTALLATION, OVERHEAD, AND PROFIT FOR ADDITIONAL WORK AND MISCELLANEOUS ITEMS THAT ARE NOT IDENTIFIED IN THE CONSTRUCTION DOCUMENTS AND PLANS, AND NOT INCLUDED IN THE BID ITEMS OF THE CONTRACT.

B. THE ALLOWANCE SHALL BE USED ONLY AT THE DISCRETION OF THE CITY. ANY ALLOWANCE BALANCE REMAINING AT THE COMPLETION OF THE PROJECT SHALL REMAIN PROPERTY OF CITY OF TULSA.

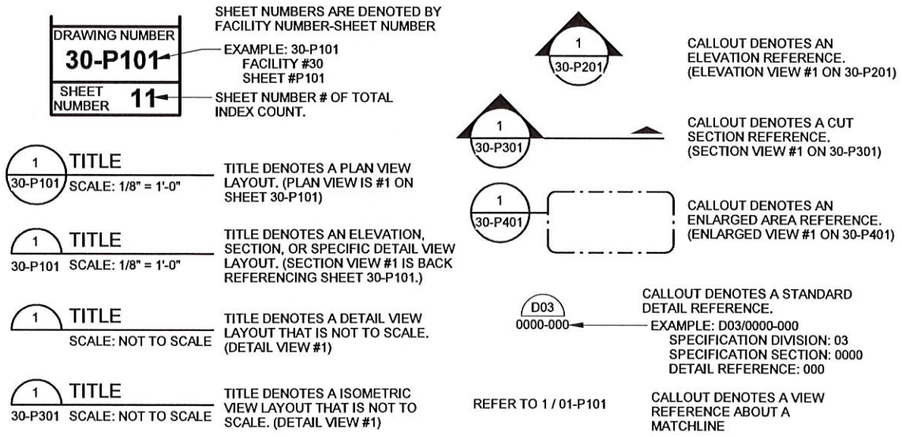
C. THE CONTRACTOR SHALL PROVIDE, TO THE CITY, A WRITTEN REQUEST FOR THE USE OF ANY ALLOWANCE, WITH A SCHEDULE OF VALUES, AND ALL ASSOCIATED BACKUP INFORMATION, INCLUDING ANY TIME EXTENSIONS REQUIRED TO PERFORM THE WORK.

D. THE CONTRACTOR SHALL PROCEED WITH THE WORK INCLUDED IN THE ALLOWANCE ONLY AFTER RECEIVING A WRITTEN ORDER FROM THE ENGINEER AND CITY AUTHORIZING SUCH WORK. PROCEEDING WITH WORK IN THE ALLOWANCE WITHOUT A WRITTEN ORDER FROM THE CITY WILL BE AT THE CONTRACTOR'S EXPENSE.

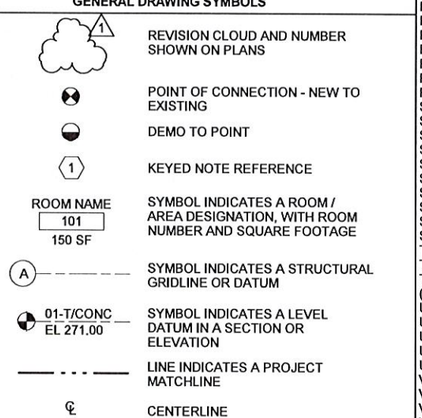
GENERAL PAY ITEM NOTES:

1. REFER TO GENERAL CONDITIONS FOR ADDITIONAL INFORMATION RELATED TO BASIS OF PAYMENT FOR BID ITEMS.
2. BID ITEMS SHALL COMPLY WITH ALL REQUIREMENTS IN THE LATEST VERSION OF CITY OF TULSA SPECIFICATIONS, INCLUDING SECTIONS 701, 702, AND 730.

VIEW REFERENCE & TITLE SYMBOLS



GENERAL DRAWING SYMBOLS



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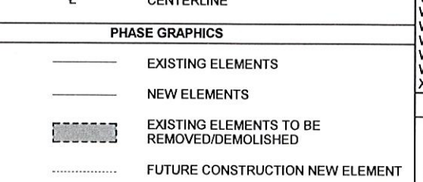


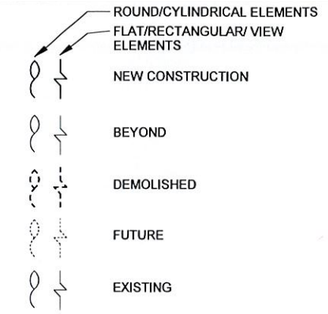
ABBREVIATIONS

ABV	ABOVE
AFF	ABOVE FINISHED FLOOR
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AUX	AUXILIARY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BKR	BREAKER
BOP	BOTTOM OF PIPE
BOS	BOTTOM OF STRUCTURE
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTERLINE
CMU	CONCRETE MASONRY UNIT
COGEN	COMBINED HEAT AND POWER GENERATION
COL	COLUMN
CONT	CONTINUOUS
DIA	DIAMETER
EA	EXHAUST AIR, EXPANSION ANCHOR, EACH
EL., ELEV	ELEVATION
ELEC	ELECTRICAL
ENCL	ENCLOSURE
FA	FIRE ALARM
FFE	FINISHED FLOOR ELEVATION
FL	FLOW LINE
FLR	FLOOR
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FEET, FOOT
GA	GAUGE, GAGE
GALV	GALVANIZED
GFI, GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GRND	GROUND
H, HT	HEIGHT
HOA	HAND-OFF-AUTOMATIC
HORIZ	HORIZONTAL
HP	HORSEPOWER, HEAT PUMP
HYD	HYDRANT
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
KVA	KILOVOLT-AMPERES
KW	KILOWATTS
LBS, #	POUNDS
LF	LINEAR FEET
MAX	MAXIMUM
MIN	MINIMUM
N/A	NOT AVAILABLE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED
OH	OVERHEAD
OSHA	OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
PD	PROCESS DRAIN
PIV	POST INDICATOR VALVE
PNL	PANEL
PRV	PRESSURE RELIEF VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE
RE:	REFERENCE, REFER
REINF	REINFORCEMENT
REQD	REQUIRED
RM	ROOM
SEC	SECTION
SF	SQUARE FEET
SHT	SHEET
SPEC	SPECIFICATIONS
SQ	SQUARE
SST	STAINLESS STEEL
STA	STATION
STD	STANDARD
SURF	SURFACE
SUSP	SUSPEND, SUSPENDED
T&B	TOP AND BOTTOM
THRU	THROUGH
T/	TOP OF
(TYP)	TYPICAL
U/F	UNDER FLOOR
U/G	UNDER GROUND
U/S	UNDER SLAB
UL	UNDERWRITERS LABORATORIES, INC.
UNO	UNLESS NOTED OTHERWISE
V	VOLT, VALVE
VA	VOLT-AMPERE
VERT	VERTICAL
W	WATT, WIRE, WIDTH, WINDOW, WATER
W/	WITH
W/O	WITHOUT
WS	WATERSTOP
WT	WATERTIGHT, WEIGHT
XMFR	TRANSFORMER

GENERAL SHEET NOTE

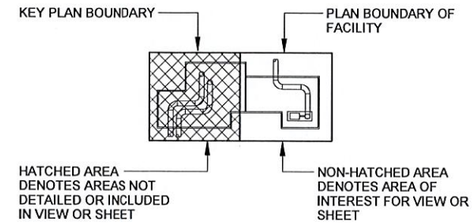
ALL GENERAL NOTES ON THIS SHEET ARE TO BE APPLIED TO ALL DRAWINGS IN THIS SET UNLESS OTHERWISE NOTED PER DISCIPLNE. SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET MAY OR MAY NOT BE USED IN THE CONTAINED REFERENCE DRAWINGS.

CONTINUATION SYMBOLS



KEY PLAN LEGEND

KEY PLANS MAY OR MAY NOT CONTAIN EQUIPMENT, PIPING OR OTHER MODELED ELEMENTS. FOR REPRESENTATION PURPOSES ONLY.



OPERATIONAL LIMITS NOTES:

1. CONSTRUCTION SHALL COMMENCE NO EARLIER THAN OCTOBER 1, 2026 AND MUST REACH SUBSTANTIAL COMPLETION BY APRIL 30, 2028.
2. CHEMICAL STORAGE TANKS CONSTRUCTION CAN ONLY OCCUR BETWEEN NOVEMBER 1ST AND APRIL 30TH.

MILESTONES:

1. DRY POLYMER EQUIPMENT DEMOLITION TO START BY NOVEMBER 15, 2026.
2. COMPLETE CHEMICAL STORAGE TANK AND OTHER LONG LEAD EQUIPMENT ITEM SUBMITTALS BY JANUARY 15, 2027.
3. ORDER CHEMICAL STORAGE TANK AND OTHER LONG LEAD EQUIPMENT ITEMS BY FEBRUARY 15, 2027.

Digitally Signed 06/30/2026

DRAWING NO.	GENERAL CONVENTIONS AND ABBREVIATIONS
01-G003	

PROJECT NO. TMUA-W 24-03

MOHAWK WTP CHEMICAL TANK REPLACEMENT

CITY OF TULSA, OKLAHOMA
WATER AND SEWER DEPARTMENT

PLANS AND ESTIMATES PREPARED BY:
GARVER

REVISION	BY	DATE
ADDENDUM NO. 1	SJS	06/30/26

PLAN SCALE: AS SHOWN	DRAWN	JAS	FEB. 2026	APPROVED:
	DESIGNED	SJS	FEB. 2026	
PROFILE SCALE:	SURVEY			
HORIZONTAL: AS SHOWN	PROJ. MGR.			
VERTICAL: AS SHOWN	LEAD. ENGR.			
	FIELD MGR.			
FILE:				DESIGN MANAGER
ATLAS PAGE NO:				DATE FEBRUARY 2026
				SHEET 03 OF 46 SHEETS

Revit File: Autodesk Docs://W02-250243 - TMUA Mohawk WTP Chemical Tank/TMUA_Mohawk WTP Chemical Building.rvt
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QUESTIONS AND ANSWERS
TO THE BID DOCUMENTS
For the Construction of
TMUA-W 24-03 Mohawk Chemical Tank Replacement
City of Tulsa

Question No.	Specification Section	Drawing/ Detail Number	Question	Response	Addendum Information
1	43 41 45		Update structural limits for withstanding continuous vacuum of -1 psig to +3 psi	Vacuum pressures to be udpated.	Addendum No. 1
2			What is the height from the floor to the existing HVAC ducts?	18 Feet from floor to bottom of duct supports according to building scan.	
3	02 41 00		Who is responsible for draining and residual chemical(s) within the tanks.	Contractor is to coordinate with plant operations to get the tanks as low as possible than transfer the remaining chemical to the tank(s) staying in operation. Contractor responsible to neutralize and dispose of any residual chemicals left in tanks.	Addendum No. 1
a.	02 41 00		If it is the contractor's responsibility, where shall the chemical(s) be drained/disposed of? Additionally for residual chemical leftover in the tanks can the chemical(s) be diluted and drained/disposed of on-site?	Coordination with plant staff is required to transfer resdiual chemicals to permanent storage to minimize chemical	Addendum No. 1
b.	02 41 00		Please address this question per chemical if the answers vary.	Same for all chemicals	
4	40 23 39, 40 23 39.46, 40 23 39.63, 40 05 07	07-P103, 07-P401, 99-P501	To properly coat the chemical pipe trench for Alternate No. 1 all piping, valving, supports, and appurtenances will need to be removed. Shall the contractor reinstall or replace the existing piping, valving, supports, and appurtenances? If replacement is required what specification(s) shall be utilized?	All pipes, supports, and valves to be replaced in the pipe trench whether or not the trench is recoated. All supports and hardware to be minimum 304 stainless steel.	
5	01 50 00, 43 42 56	07-P103, 07-P401	Regarding bid item 10 "SEALLESS MAGNETIC DRIVE CENTRIFUGAL PUMPS", this bid item calls for three pumps, however, it appears that only two sodium hydroxide chemical transfer pumps are to be installed. Can it be clarified where the third pump is located or if this third pump is to be a spare?	The third pump is a temporary transfer pump to transfer HFS from IBC totes to existing HFS day tank. Data sheet to be added to specifications.	Addendum No. 1
6			Shall any work be done on the existing Sodium Hydroxide Recirculation Pump?	No, only the suction and discharge piping will be replaced.	
7			Specification Section 01 20 00 Part 1.2 identifies a chemical allowance for "supplying temporary chemicals and maintaining the temporary chemical storage system."	See answers below.	
a.			Since the City currently maintains established procurement contracts, supplier relationships, and delivery logistics for treatment chemicals, please clarify whether the City intends to continue furnishing treatment chemicals during construction, with the Contractor responsible only for providing, installing, operating, and maintaining the temporary storage and feed systems.	Existing City contract will be utilized to provide bulk quantities of the ACH and SHX to the tanks in service during construction. Contractor required to coordinate with the Plant Operations on schedule to make sure an adequate amount of chemical is stored between deliveries.	
b.			If the Contractor is intended to procure temporary chemicals under this allowance, please:		
1			Identify the approved chemical suppliers, provide contact information, and any procurement restrictions.	**Cationic Polymer - Polydyne Inc.** Steve Kuenneth 816-260-0087 **Hydrofluorosilicic Acid-Dubois Chemicals** Veronica 208-466-4624 or 208-932-6615	
2			Confirm which chemicals are included in the allowance (ACH, HFS, CPO, SHX, or others).	HFS and CPO in totes for temporary system.	
3	01 50 00		Provide anticipated chemical consumption rates and required delivery capacities for each chemical system to allow proper sizing of temporary storage, piping, pumps, and associated equipment.	The specifiation has estimated quantities of HFS and CPO for 30 days supply of onsite storage.	
8			Are the three ACH day tanks that sit east of the CPO tank allowed to be removed during the construction of the project? If so, will there be any temporary chemical supply, containment, etc. associated with this?	Based on proposed construction sequence one ACH tank is to remain in service at all times with a temporary hose connection to the day tanks. Contractor responsible to manage remaining volume of chemical in tanks as demolition and replacement is occuring. Coordination with plant operations is essential to minimize risk of transferring or disposing of chemical. Contractor has the option to provide their	
9	01 14 00		The specified construction window of November 1, 2026, through April 30, 2027 appears restrictive considering typical contract award timing, submittal review and approval durations, and FRP tank/equipment lead times. Please confirm whether the Owner/Engineer anticipates an expedited award process and expedited submittal review/approval process to accommodate the specified construction window and identify any scheduling assumptions used in establishing this timeframe.	Construction window has been updated to Nov 1, 2027 - April 30 , 2028.	Addendum No. 1
10	43 41 45		A request to add Belding Tank as an acceptable manufacturer to the FRP specification.	Belding Tank has been included in the specification.	Addendum No. 1
11	43 41 45		Please check with the engineer as soon as possible and have them get back with me so that we can get tanks quoted by the deadline. The specified heights in the drawings, and the tanks working capacity volume called out in the tables within the specification do not align when volumes are calculated. Using an estimated overflow elevation (Tank Height -2 ft), the calculated tank volumes will be short of the tank's working capacity. See below. What do they want the tanks built to? Also, is the working capacity to the bottom of the overflow, or a lower elevation? Overflow elevations are not called out, that is why the calculation below assumed it to be 2 ft below top of tank.	Tank Height, Overflow height, and working volume have been updated for all tanks.	Addendum No. 1
12	01 20 00, GC-26, and Special Provision Owners Allowance OA-1		Can the method of payment and progress billing for this line item be clarified? For example, will the allowance be paid as a lump sum based on the percentage of completion during the use of temporary chemicals, or will the City of Tulsa require supporting documentation for labor, equipment, materials, overhead, and profit with each billing cycle?	Supporting documentation for labor, equipment, materials, overhead, and profit will be required each billing cycle as outlined in Special Provisions Owner Allowance.	Addendum No. 1
13	01 20 00, GC-26, and Special Provision Owners Allowance OA-1		Additionally, if the contractor's costs for temporary containment, chemicals, labor, equipment, materials, or other associated expenses exceed the allowance amount, how will the contractor be compensated for those additional costs?	The allowance is only for the cost of labor maintaining the temporary system and procuring of the HFS and Cationic polymer chemicals only. All cost to construct the temporary chemical system should be Bid Item 1. Any additional cost, beyond the Chemical Allowance, will fall under Bid Item 15.	
14	40 61 63		Difficulty contacting DCS integrator named in specification.	Added Prime Controls as approved DCS Integrator. Contact Clayton Seale, 972-221-4849, cseale@prime-controls.com ABB Contact: Natalie Andrews 469-794-4313 natalie.andrews@us.abb.com	Addendum No. 1
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